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December 1979
vol 5, no 12
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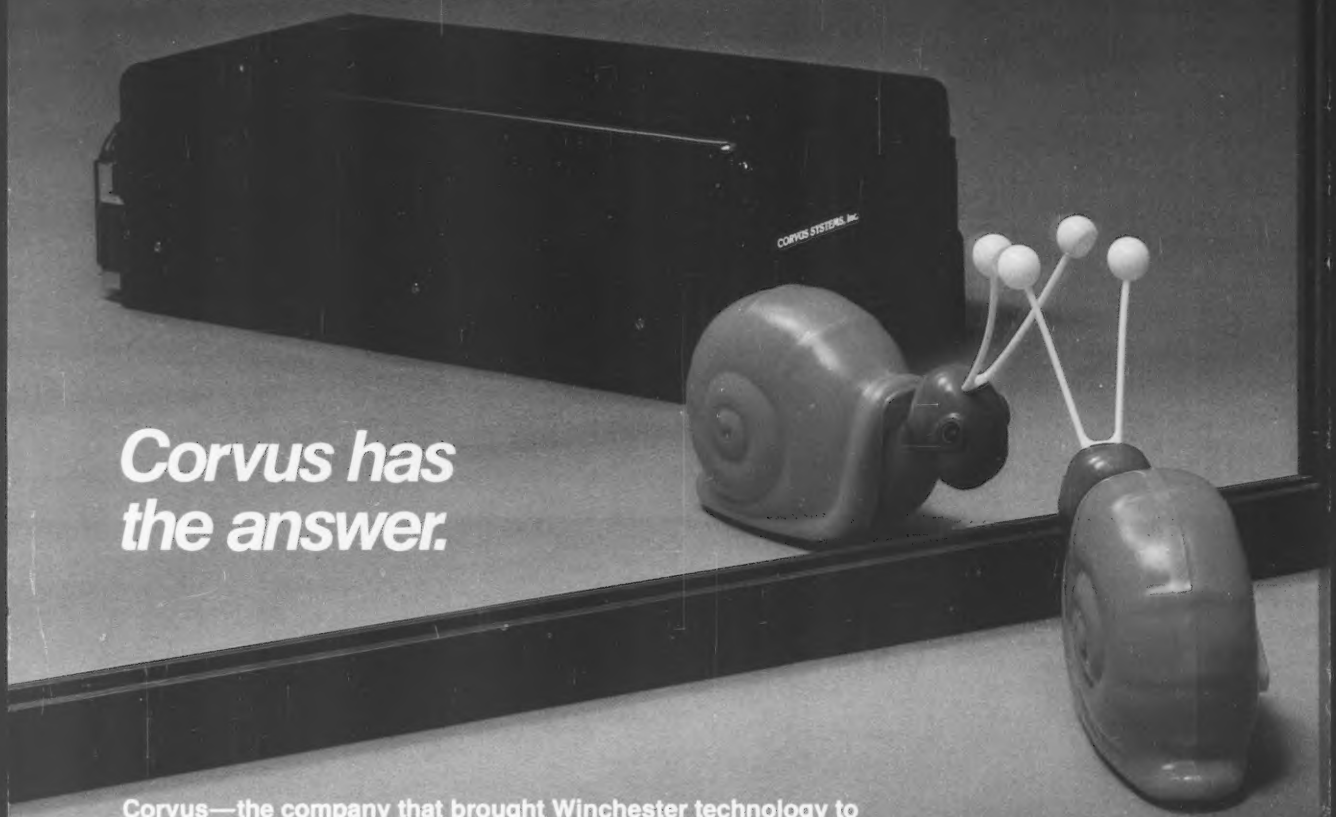

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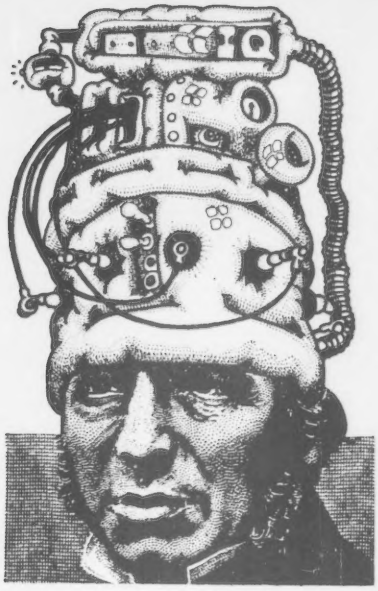

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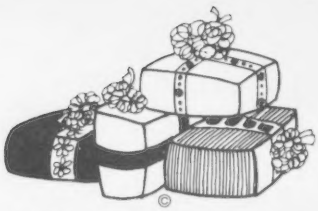

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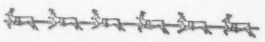

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Creative Computing magazine is published monthly by Creative Computing, P.O. Box789-M, Morristown, NJ 07960. (Editorial office: 51 Dumont Place, Morristown, NJ 07960 Phone: (201) 540-0445.)

Domestic Subscriptions: 12 issues, $15, 24 issues $28, 36 issues $40. Send subscription orders or change of address (P.O. Form 3575) to Creative computing, P.O. Box 789-M, Morristown, NJ 07960. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription (to be charged only to a bank card).

Second class postage paid at Morristown, New Jersey and at additional mailing offices.

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THE COVER

Our cover illustration is by Barclay Shaw, an illustrator working out of Boston. Barclay recently switched from woodworking to art and has had works published in several sci fi magazines. We took some liberties with his original illustration making it into a spaceman landing on a distant planet and encountering only a TV set with a video game on the screen.

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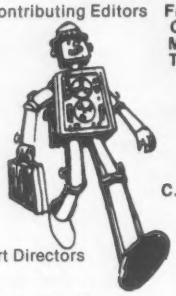

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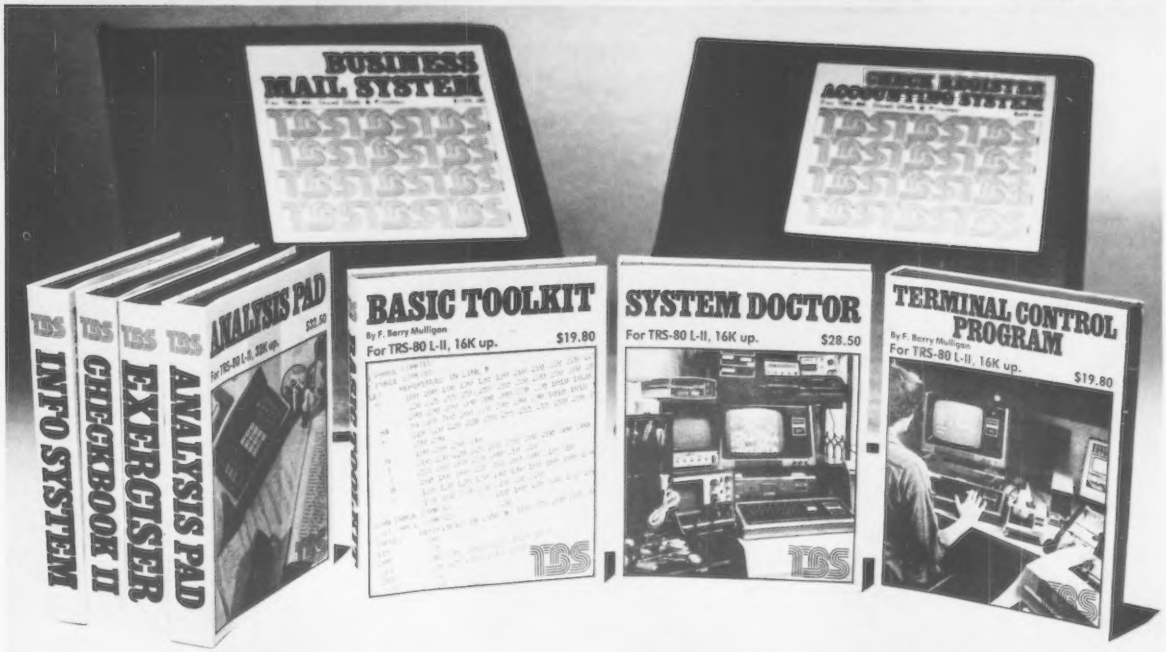

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SYSTEM DOCTOR does a thorough diagnostic check of your entire computer system. It lets you know if something is wrong before you spend time programming or entering data. The program checks the ROM to ensure that every bit is functional and checks the RAM six different ways. The disk drives are tested in a variety of ways to ensure reliability. The cassette recorder is also tested for speed, volume and distortion with the help of a calibration tape provided with the program. The video memory and display are also checked as well as the line printer. **SYSTEM DOCTOR** also does a 12-hour check of the entire system and records the results on tape, disk or the screen. As a bonus, this program also includes the **DISK DRIVE HEAD CLEANER**. The card insert that cleans the head can be obtained free by mailing in the coupon provided. For $28.50, **SYSTEM DOCTOR** is the first complete diagnostic program for the TRS-80.

TERMINAL CONTROL by F. Barry Mulligan is a machine language utility that enables you to use all the potentials of RS-232 tele-communications without hassel. It can interface to any Level II BASIC or assembly language program, or may be used as a stand-alone system to send and receive entire programs or data. The beauty of this program is that it turns your computer into a truly smart terminal. All RS-232 features can be set from the keyboard and the current values can be displayed or changed at any time. Basic programs can be sent in Level II compressed format for high-speed exchange. Whether you want to send or receive data from a basic program, save what comes down the line, converse with any other terminal or computer, exchange programs, or try any of the possibilities that computer communications has opened up, **TERMINAL CONTROL** is your answer. Only briefly described here, this remarkable program sells for only $19.80.

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Editorial

John Craig

"...as happened with television and then color television, the enthusiasts and the well-to-do will be the first to install computer consoles in their homes. Eventually, however, everyone will consider them to be essential household equipment. People will soon become discontented with the 'canned programs' available; they will want to write their own. The ability to write a computer program will become as widespread as the ability to drive a car."

Scientific American
September, 1966

I wonder if the person who wrote that passage in 1966 had any idea what the 1970's held in store for his ideas on personal computing? Aside from the fact that he was thinking in terms of time-share terminals in every home, rather than **computers** in every home, I feel he pretty much hit it on the head. There are some perceptive thoughts in that piece, especially about the computer literates we'll have in the future. We're already headed in that direction...in schools, in the home and even in the office. The 1970's have been the dawning of a new era and it's definitely exciting to be a part of it...but the real fun is coming up in the 80's.

Looking Back

This whole thing really got started around 1972 when Intel announced their new 4-bit microprocessor, the 4004. This was followed in short order by the 8008, an 8-bit microprocessor. Intel was going after the industrial, dedicated-controller market with these devices and it's doubtful they ever even gave a second thought to the possibility of a personal computing market. I, and many others, got hooked into this mess in 1974 with the publication of an 8008-based microcomputer construction article, by Jonathan Titus, in the June issue of **Radio-Electronics**. Jon Titus' computer was called the Mark-8 and a friend of mine, Hal Singer, formed a user's group of Mark-8 builders. The first issue of the **Mark-8 Newsletter**, in September, 1974, went out to a mere 30 members and a year and a half later, in March of 1976, long after the name had been changed to the **Micro-8 Newsletter** (to encompass all of the micros coming on the scene), it was being read by approximately 2,000 people. Not a very large number when compared to today's magazines... but it was a beginning.

All hell broke loose in 1975. MITS introduced the Altair 8800 through a couple of "construction" articles in Popular Electronics (which were really nothing more than glorified advertisements). However, it worked. Thousands of people ordered Altair kits and MITS found themselves up to their eyeballs trying to dig out from under the backorders. Those who were able to get an Altair soon found that it was almost impossible to get anything to go with it, especially memory. As a result, several companies (soon to become hundreds) went into the business of manufacturing boards for the "S-100" (standard, 100-pin) bus. Most of those companies are still with us but some of them have gone on to the great computerland in the sky.

Several of the major magazines in the personal computing field had their beginning in 1975...with the exception of **Creative Computing**. David Ahl started **Creative** in November, 1974 as a magazine for educational computing and over the years has been the only one actively serving that market...in addition to the growing personal computer field. In September of 1975 **Byte Magazine** made its debut followed in December by **SCCS Interface**, the magazine of the Southern California Computer Society. **SCCS Interface** has since gone on to become **Interface Age** and **Byte** has gone on to become "a McGraw-Hill Publication - a definite indication of its success.

1975 was also the year of the computer club. The Homebrew Computer Club was started in the San Francisco area in Gordon French's garage one evening...the first meeting of the Southern California Computer Society was held in the rec room at Don Tarbell's apartment building...Sol Libes started the Amateur Computer Group of New Jersey, which has grown to become the largest club in the country. Similar scenes were occurring all over the country as hobbyists realized clubs were a valuable resource for obtaining and sharing information. Many clubs are still the best way for newcomers to get information on different systems and pick up ideas and support for their new hobby. Another resource for newcomers, and old-timers alike, are the local computer stores with their training classes and, in most cases, a variety of systems to choose from. And, speaking of stores, 1975 gave birth to the first one; Dick Heiser's Computer Store in Santa Monica, California.

The First World Altair Computer Convention was held in March of 1976 in Albuquerque and was, among other things, the first major computer convention of the industry. Even though the show was put on by MITS, for the benefit of MITS, it attracted people from all over the country and was quite a happening. Luckily, MITS didn't go through with plans for The Second WACC in 1977 because it sure would have been a disaster. By then PC '76 in Atlantic City and the First West Coast Computer Fair in San Francisco had established themselves as the leading shows in the field.

1976 saw the introduction of a new computer, called the Apple, which was developed and originally produced by Steve Wozniak and Steve Jobs as a garage-type operation. It's now a multi-million dollar a year corporation because Steve and Steve had the good sense to turn over the management of the company to professionals and settle for a percentage of something, rather than possibly 100% of nothing. In 1977 there was a tremendous amount of editorial coverage by personal computing and professional publications for the Personal Electronic Transactor, from a calculator company called Commodore (which got the daylights whomped out of it earlier in the decade by Texas Instruments). it

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CIRCLE 114 ON READER SERVICE CARD

Editorial, con't...

gained the dubious distinction of probably being the only computer **system** shipped to customers with only 10 loose pages as the complete documentation. Heath made its long-awaited entry into the field with the H8 and H11 and later came to realize that CP/M and Microsoft BASIC weren't so bad after all and made them available for the H8. 1977 also saw the introduction of the dcade's big winner...the TRS-80 from Radio Shack. They had no idea what they were getting into, but when it became clear there was a tremendous market out there, they didn't wallow around in the mud of uncertainty...they geared up and went after it.

Two new magazines, **Kilobaud** and **Personal Computing** made their debuts in 1977 and **Microtrek**, after two issues, bit the dust. We were also blessed with the first major swindle to hit the industry in 1977...our friend, "Colonel" Winthrop, and his DataSync operation. And, just to show he cared, he dropped by to see us again this year...as World Power Systems.

The most significant thing about 1978 and 1979 is that a certain maturity began to emerge within the industry. Sophisticated, and useable, software began to come on the scene for small business applications and the home. Graphics games which could hold a candle to, and compete with, home video games also came into being. But, perhaps most importantly, an increasing

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Looking Ahead

The last decade may have been fun and interesting but the next one will be fascinating. Two new developments whould continue to grow in popularity; multi-user/multi-tasking systems and personal computer networks. And, we should be seeing even more sophistication in educational and entertainment graphics and games.

The 80's will very likely present us with some unexpected problems and surprises along the way. For one thing, our industry doesn't have a voice (a lobbyist, if you will) in the halls of Congress to look out after our interests. I'd be willing to bet we'll run into situations in the 80's where we wish we did have someone there. We live in a world of special interests and we'd better make sure someone is looking out for ours. One of the long-term goals of the Microcomputer Industry Trade Association (MITA) is to provide for such a lobbyist and that's one of the reasons I hope MITA becomes a real and meaningful organization. The Ribicoff Bill now in Congress is an example of the kind of legislation we need to look out for. Several provisions of that bill, if it becomes law, will make some of us guilty of criminal activity while using home systems and/or networks. The legislators aren't even consulting the data processing industry...much less the personal computing industry. Another thing our "interests watcher" could be doing is keeping track of the legislation coming out of various state legislatures.

I've made a resolution that in the future I'm going to try to temper my enthusiasm for new systems when they're first introduced. At the Consumer Electronics Show in Las Vegas, in January of this year, I got excited about the entry of Cybervision, APF, Teal and Mattel into the market...and I couldn't wait to tell everyone about it. Now I wish I hadn't. Where the heck are they? Do you know anyone with these computers? I sure don't. I also get the impression that these companies feel hobbyists are a segment of the market that they're not interested in going after. I may not have a degree in marketing but I'll bet my money that they're missing a good bet. This "hobbyist" base is probably one of the most important foundations for any company entering this field to build upon. An example is the MITS Altair. It didn't become a success because MITS gladly helped everyone with interface diagrams and technical specs. It became a success in spite of their attitude and it would have been even bigger in the beginning if they had been helpful. And, it would probably still be around today if some different marketing strategy had been applied in the long run. The Radio Shack TRS-80 and Apple systems have enjoyed tremendous popularity and a great deal of it is due to the many, many hardware and software entrepreneurs who have developed products for the machines. Where would it be now if everyone had simply waited for Radio Shack and Apple to develop and deliver the hundreds of products now available? I recently received a news release for Heath Company which stated they're going to be making cash payments to members of the Heath User's Group who develop new H8 interface designs. See what I mean? There's a company that realizes the value of that "hobbyist" base...and is going after the talent there.

Then we have Texas Instruments. What a disappointment. After all the expectations and hype (generated mostly by us magazine editors) they come on the scene with a system that sells for over a thousand dollars. Anybody could do that. I honestly figured they'd come bouncing in with a four or five hundred dollar system, with loads of capability, that would knock the slats out from under everybody. Quite frankly, I get a lot more excited about a new system from Dick Smith Electronics in Australia which looks like a Sorcerer, has a built-in TRS-80 compatible cassette, Level II BASIC, sells for $595 with 4K...and uses the S-100 bus for expansion. The only drawback is that I don't believe it will generate TRS-80 graphics but a person could get CP/M up and running rather quickly with some serious business software if that was the objective. (Now that I've told you about it, chances ar they won't even be exporting them.)

Whatch out for Digital Equipment Corporation and IBM. They know what's going on and the only way we're going to be able to contend with their intrusion into the market is to know what they're doing. DEC is opening up more and more of their small business systems stores around the country and IBM is spending big bucks on radio, TV and magazine ads trying to convince the small businessman that the 5100 is the answer. They're smooth and sophisticated when it comes to going after that business market, and you can be certain when it becomes evident the home market is worth going after, they'll be just as smooth.

We've got some exciting things coming up in the 80's and I sincerely hope you'll be with us in the pages of **Creative Computing**. □

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CIRCLE 125 ON READER SERVICE CARD

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et cetera

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1. TITLE OF PUBLICATION		2. PUBLICATION NO.	3. DATE OF FILING
Creative Computing		0 8 8 8 3 0	October 25, 1979
4. FREQUENCY OF ISSUE		4A. NO. OF ISSUES PUBLISHED ANNUALLY	4B. ANNUAL SUBSCRIPTION PRICE
Monthly		12	$15.00

4. LOCATION OF KNOWN OFFICE OF PUBLICATION (Street, City, County, State and ZIP Code) (Not printers)
51 Dumont Place, Morristown, New Jersey 07960

5. LOCATION OF THE HEADQUARTERS OR GENERAL BUSINESS OFFICES OF THE PUBLISHERS (Not printers)
51 Dumont Place, Morristown, New Jersey 07960

6. NAMES AND COMPLETE ADDRESSES OF PUBLISHER, EDITOR, AND MANAGING EDITOR

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Looking to buy a computer, peripheral, software package or electronic game? Creative's in-depth evaluations can probably help you make a better decision. Presented here is a list of the products reviewed by Creative over the last three years. Back issues, when available ("Yes" in last column), cost $2.00 each, three for $5.00, or ten for $15.00. Postage is $1.00 for up to 3 issues or $2.00 for 4 or more. Order from Back Issues, Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

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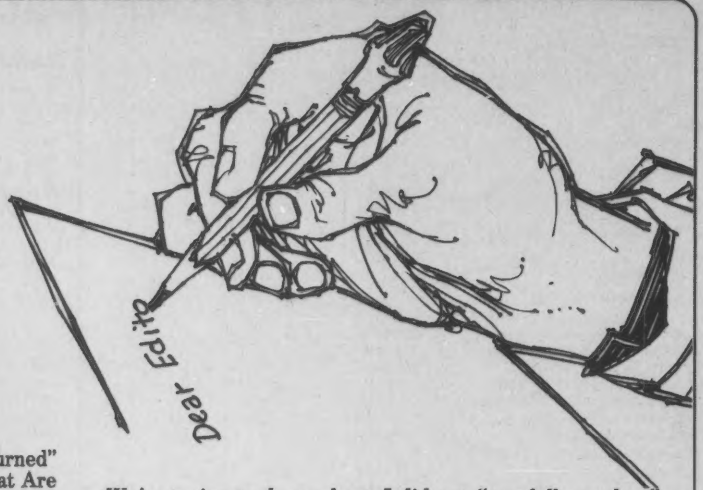
CIRCLE 178 ON READER SERVICE CARD

Product and Manufacturer	Type Review	Vol:No./Page	Available
COMPUTER SYSTEMS			
26 Single Board Computers	Comp. Chart	5:11/24	Yes
6 Personal Computers	Comp. Chart	5:11/30	Yes
Altair 8800	Single	2:1/13	No
"	Follow up	2:6/25	Yes
APF PeCos One	Single	5:7/26	Yes
Apple II	Single	4:4/28	Yes
Bally Home Computer	Single	4:5/56	Yes
Compucolor II	Single	5:9/28	No
"	Single	5:10/30	Yes
Heathkit H-8	Single	4:1/38	Yes
"	Building	5:2/17	Yes
Hewlett Packard 9815A	Single	2:5/18	Yes
IMSAI 8080	Single	3:1/30	Yes
Interact Model One	Short	5:8/24	Yes
"	Single	5:11/36	Yes
Monroe Classmate 88	Single	5:9/32	No
North Star Horizon	Single	4:6/54	Yes
Ohio Scientific C2P	Single	4:3/42	No
Ohio Scientific C4P MF	Short	5:8/22	Yes
Ohio Scientific Superboard	Single	5:1/120	Yes
Pet 2001 (Commodore)	Single	4:4/24	Yes
PolyMorphic 8813	Single	4:5/44	Yes
Sol-20 (Processor Technology)	Single	3:3/32	No
Sorcerer (Exidy)	Single	4:5/33	Yes
"	Single	5:1/88	Yes
Southwest Technical Prod 6800	Single	3:1/33	Yes
Radio Shack TRS-80, Level I	Single	4:1/35	Yes
"	Manuals, Software	4:3/22	No
Radio Shack TRS-80, Level II	Single	4:5/48	Yes
Radio Shack TRS-80, Model II	Single	5:8/30	Yes
Tektronix 4051	Single	2:6/20	Yes
"	Manuals	3:2/103	No
Texas Instruments 99/4	Single	5:8/28	Yes
Video Brain (Umtech)	Single	4:3/52	No
"	Software	5:3/84	Yes
Wave Mate Jupiter II	Single	3:3/30	No
Xitan Alpha 2 (TDL)	Single	3:6/46	Yes
TERMINALS, PRINTERS AND I/O			
Heath H-14 Line Printer	Single	5:10/34	Yes
IMSAI VIO Video Board	Single	5:8/38	Yes
Integral Data Brighter Writer	Single	5:7/17	Yes
Malibu 160 Line Printer	Single	5:5/52	Yes
Merlin Video Interface	Single	4:5/52	Yes
SWTPC CT-82 Graphics Terminal	Single	5:7/20	Yes
SWTPC PR-40 Printer	Single	5:8/32	Yes
Teletype 43	Single	3:1/29	Yes
Texas Instruments 810 Line Printer	Single	5:9/38	No
TRS-80 Quick Printer II	Single	5:11/32	Yes
PERIPHERALS			
Ai 1000 Speech Synthesizer	Single	4:3/36	No
ALF 10-5-9 Music Board	Comparative	4:3/28	Yes
ALF Apple Music Board	Single	5:6/102	Yes
Apple Disk II	Single	5:3/124	Yes
Bit Pad (Summagraphics)	Single	4:4/43	Yes
BSR/Sears Home Controller	Single	5:11/60	Yes
Computalker Speech Synthesizer	Single	4:5/62	Yes
Heath H-17 Disk System	Single	5:9/42	No
Heuristics Speechlab	Single	5:7/30	Yes
HiPlot Plotter (Houston Inst)	Single	5:6/28	Yes
Introl X-10 Home Controller	Single	5:11/54	Yes
Midwest Scientific Floppy Disk	Single	4:3/44	No
Newtech 6/68 Music Board	Comparative	4:3/28	Yes
Periphicon 511 Image Digitizer	Single	5:10/25	Yes
Sel-Tronics Cassette Interface	Short	5:6/124	Yes
Software Technology Music System	Single	3:5/96	Yes
Solid State Music SB-1	Comparative	4:2/28	Yes
Supertalker (Mt. Hardware)	Single	5:10/42	Yes
Terrapin Turtle	Single	5:3/105	Yes
Thinker Toys Floppy Disk	Single	5:2/24	Yes
TRS-80 Floppy Disk	Comparative	5:3/22	Yes
TRS-80 Speech Synthesizer	Single	5:6/96	Yes
SOFTWARE - LANGUAGES & SYSTEMS			
Basic Etc	Comparative	3:6/50	Yes
CBasic (Software Systems, Inc)	Single	5:9/48	No
CP/M Operating System	Single	4:6/52	Yes
Cromemco 3K Control Basic	Short Comp	3:5/83	Yes
Dynamic Debugger (CMNJ)	Single	3:5/26	Yes
ENPL (Micro APL)	Single	4:2/88	Yes
IMSAI 8K Basic 1.4	Comparative	3:6/49	Yes
Microsoft Basic 4.0	Comparative	3:6/48	Yes
Microsoft Basic 4.0 Extended	Comparative	4:2/84	Yes
Microsoft Fortran 80	Single	5:1/62	Yes
Palo Alto Tiny Basic	Short Comp	3:5/83	Yes
Pet Monitor (Home Computer Center)	Single	5:3/49	Yes
Processor Tech 5K Basic	Short Comp	3:5/83	Yes
SAM76 - TRS-80 Version	Short	5:7/114	Yes
SMAL/80	Short	3:5/118	Yes
SWTPC 8K Basic 2.0	Comparative	4:2/87	Yes
Tiny C	Single	5:1/68	Yes
TRS-80 Level III Basic	Single	5:11/42	Yes
SOFTWARE - APPLICATIONS			
Channel Data Book (for Pet)	Single	5:3/26	Yes
Checkbook Maintenance (Computerware)	Single	5:4/135	Yes
CLOAD Magazine	Single	4:6/36	Yes
Creative Software (for Pet)	Single	5:11/46	Yes
Data Base Management (Cromemco)	Single	5:3/128	Yes
Data Management (CCA)	Single	5:3/82	Yes
Electric Paintbrush - TRS-80	Short	5:9/188	No
File Handling - TRS-80 (Circle)	Short	5:7/114	Yes
File-It - TRS-80 (Practical Appl)	Single	5:3/148	Yes
Instant Software (for Pet)	Comparative	5:1/105	Yes
Interactive Microware	Short	5:4/25	Yes
Library 100 (The Bottom Shelf)	Single	5:4/24	Yes
Microchess 1.5	Single	5:1/78	Yes
"	Short	5:2/102	Yes
"	Comparative	5:10/68	Yes
Micro Pro Super Sort	Single	5:7/34	Yes
MUSE Software (for Apple)	Comparative	5:1/104	Yes
Name & Address System (Structured)	Single	5:6/76	Yes
PDI IC Builder	Single	5:5/70	Yes
Pet Diagnostics (Commodore)	Single	5:7/32	Yes
Pet Educational Cassettes (Peninsula School)	Single	4:5/68	Yes
Sargon Chess (Hayden)	Comparative	5:10/68	Yes
Softside Software (for TRS-80)	Short	5:1/28	Yes
Speakeasy Software (for Apple)	Comparative	5:1/105	Yes
TRS-80 In-Memory Info System	Single	5:3/107	Yes
TRS-80 Math & Algebra Packages	Single	5:3/58	Yes
TRS-80 Personal Finance	Short	5:2/103	Yes
User-Defined Character Generators (for Apple)	Comparative	5:11/38	Yes
Video Checkers (Compu-Quote)	Single	5:4/137	Yes
WPATSIT Data Base System	Single	5:4/122	Yes
WORD PROCESSING SYSTEMS AND SOFTWARE			
Digital Research ED, TEX	Comparative	5:10/50, 5:11/48	Yes
Electric Pencil	Single	5:2/30	Yes
"	Comparative	5:10/50, 5:11/48	Yes
IDSWord	Single	5:5/43	Yes
Ohio Scientific WP-1	Single	4:4/131	Yes
Peachtree Software	Single	4:4/133	Yes
Peripherals Unlimited	Single	5:5/46	Yes
Smoke Signal TP-1	Single	5:1/76	Yes
Technical Systems Consultants Edit, PR	Comparative	5:10/50, 5:11/48	Yes
Text 2000 (Info 2000 Corp)	Single	4:4/128	Yes
Wordmaster (Micro Pro)	Single	5:5/50	Yes
Word Master (PolyMorphic 8813)	Single	5:5/34	Yes
WPDaisy (TSA)	Single	5:5/36	Yes
SOFTWARE - PAYROLL PACKAGES			
MITS	Single	4:3/126	No
Osborne & Associates	Single	4:3/121	No
Radio Shack	Single	4:3/124	No
Scientific Research Inst.	Single	4:3/128	No
ELECTRONIC AND VIDEO GAMES			
Group Review - Christmas 1977	Short	3:6/34	Yes
- Christmas 1978	Short	4:6/70	Yes
- Toy Fair 1979	Short	5:5/16	Yes
- Christmas 1979	Short	5:10/12	Yes
Amaze-A-Tron (Coleco)	Short	4:6/71	Yes
Atari Video Pinball	Single	4:4/35	Yes
Atari Video Computer System 1979 Cartridges	Single	4:4/37	Yes
Boris Chess	Single	5:10/38	Yes
Checker Challenger	Comparative	5:10/68	Yes
Chess Challenger	Single	5:4/120	Yes
Model X	Short	3:6/35	Yes
Level 7	Short	4:6/72	Yes
Code Name: Sector (Parker Bros)	Comparative	5:10/68	Yes
Comp IV (Milton Bradley)	Short	3:6/35	Yes
Computer Backgammon	Single	3:6/36	Yes
Electronic Battleship (M-B)	Comparative	4:6/83	Yes
Gammonmaster II	Single	4:3/47	No
Mathemagician (APF)	Comparative	4:6/83	Yes
Mattel Auto Race, Football, Missile Attack	Single	4:2/92	Yes
Odyssey 200, 300, 400	Single	4:1/27	Yes
Simon (Milton Bradley)	Single	2:6/24	Yes
Speak & Spell, Spelling Bee (TI)	Short	4:6/71	Yes
TEAMMATE Computer (Logix)	Comparative	4:5/60	Yes
Quiz Wiz (Coleco)	Short	4:6/73	Yes
	Short	4:6/71	Yes
MISCELLANEOUS			
Broder Logic Trainer	Single	5:3/66	Yes
Compic Computer Portrait System	Single	5:8/86	Yes
CompuCruise Auto Control	Single	5:4/132	Yes

Input/Output



Ethics vs. Fraud

Dear Editor:

I have just finished reading your article "Twice Burned" in the July, 79 issue. In the section entitled 'Now, What Are We Going To Do...', you assume that the public is likely to blame the mag for accepting the ads. Well, let me speak loud and clear for the million or so of us out here: Yes! we do blame you, and we understand your reasons for doing so. However, most of us do not agree that expediency and irresponsible pursuit of the dollar are adequate justification. We feel that you have an obligation to us, your readers, to screen your ads and accept only those which can be verified. Rather than throwing up your hands and pleading helplessness, take aggressive action. Model yourself, for instance, after 'Good Housekeeping' magazine, which not only carefully screens their ads, but also guarantees a refund if the customer is not satisfied. If you were legally responsible for the ads you published, I bet you would suddenly find a way to verify them.
verify them.

I want to touch on another point of your article which i think is important. You mention that there have been only a couple of out-and-out frauds in the industry, but carefully neglect the fact that there have been hundreds, even thousands, of horror stories about money paid and products not delivered for months. You encourage this by accepting ads for products which are not ready, but which are under development. They 'should be ready soon...', but often aren't. This doesn't just involve small or jack-leg companies; some of the largest have been equally guilty. Processor Technology had ads for their '8K' BASIC for a year or more before it finally emerged as a '15K' BASIC. Thinker Toys advertised for months that their disk system came with a special BASIC which, in fact, was not ready. The August '79 issue of Creative Computing carries the letter of Phillip Schnell, who paid his money over a year ago, and who is still waiting for his PET 2020 Printer.

Magazines should make it a firm rule to accept advertising only for products which are in production, tested and ready to ship. You should act agressively to screen your ad submissions. You should encourage readers to write to you about promises which are not kept, and follow up on these complaints, even to the extent of publishing them, and response if any, in the mag. Finally, you should accept ads from a company only if you are willing to lay your reputation on the line to back up the ad.

I hope to see you move forward in this area.

Lewis Moseley, Jr.
2576 Glendale Court, N.E.
Conyers, Georgia 30208

We're not throwing up our hands and pleading helplessness. It's just that we don't have the personnel or finances to research each and every potential advertiser nor do we have the inclination to dictate policy to them. Attmepting to draw a parallel between this magazine, or any other in the personal computing field, and **Good Housekeeping** *simply isn't fair. They have those resources because they're a much larger publication.*

We're trying to do our best. I did not "carefully neglect" to mention the horror stories about products not being shipped. The article was about a swindle, not legitimate companies having trouble meeting deadlines. I think it's important that everything be kept in perspective here. There are more honest companies offering products to the personal computing market than dishonest ones. Some of the companies you listed had trouble getting their products out the door but they certainly didn't **steal** *any money. We're hoping that when the Microcomputer Industry Trade Association [MITA] gets off the ground it will be able to play a role in establishing advertiser ethics and help alleviate some of these problems. In the meantime, we'll try to do our best to keep you abreast of the bad...and the good.* —JC

Genealogy, Please

Dear Editor:

I would appreciate your making a brief note in your publication about a specialized interest of mine in the hope that it might be read by others of a similar interest.

Briefly, I bought an Apple II last year in the hope that it would bring order out of chaos in the collected documentation I have of several thousand ancestors. I would like to be able to store, file, sort, retrieve, & cross-reference genealogical data. I would like to be able to have pedigree, individual and family group printouts as well as indexes. The Mormons have done excellent work, but they use IBM 370's. Some work out of the University of Utah has focused on mini's using an excellent soundex code with pointer systems for parents and progeny, but the adaptation to micros is not clear.

I would like to hear from others of a similar interest (it also has relevance to tracing genetic disorders & there are other analogs) so that possibly a network of information could be pooled and shared.

Clifton M. Howard,
58 Van Orden Road
Harrington Park
New Jersey 07640

We have some articles on Genealogy coming up. —JC

Accuracy [?] Plus

Are Bruce Barnett's (Accuracy Plus: Multiprecision Multiplication, Creative Computing, August, 1979) bytes broken or basically some bits busted? The way to check a multiplication is to divide through by the multiplier and see if you get the multiplicand.

Doug Jones

Do TRS-80's new lower prices mean you get "cheaper" computers?

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MAY IT PLEASE THE COURT?

CAMBRIDGE—The time may not be far off when the prudent lawyer will take each new case to a computer before taking it to court.

"There's really not much hope of winning, although of course the choice is up to you," he might tell his client after punching the facts into a desk-top keyboard terminal, plugging in the appropriate program for, say, child custody cases, and then shaking his head in dismay.

"The computer says that in recent cases similar to yours in similar jurisdictions, after waiting for state to state variations, the judges ruled unfavorably 76.3 percent of the time," he might say. "But if you choose to have me press suit, the computer also says we'd better hire some good expert testimony, make sure you're going to be a good witness on the stand, and hope that we don't get Judge Jones."

That vision of the law practice of the future is not yet being marketed by computer salesmen. But it is a possibility raised by a recently concluded three-year research effort conducted by Charles M. Haar, the Louis D. Brandeis Professor of Law at Harvard University, with the aid of grants by the American Bar Foundation and the National Science Foundation.

The handful of legal scholars who study the use of computers in the law have hailed his experiments as a possible omen of far-reaching changes in the legal profession.

Professor Haar, a former assistant secretary of Housing and Urban Development in the 1960's and a nationally known expert in land use planning law, programmed a computer with more than 1,200 zoning amendment appeals cases recorded by the supreme courts of six states. He was able to reduce the relevant considerations to 204 variables in scores of differently weighted combinations and found that 99 percent of the time the computer decided the cases the same way the judges had.

"I realized that lawyers were still flying by the seat of their pants most of the time and we were still assessing the chances of success exactly the same way Abe Lincoln did when he was a lawyer," Professor Haar said recently. "I wanted to be a little bit more scientific."

Such assessments and predictions, of course, are time-honored legal preliminaries. They are also tasks that Professor Haar and other legal scholars are convinced could be done a lot better with the aid of a computer.

Computers, after all, have long been doing similar tasks in areas equally subject to the whims of nature, luck and mankind: the location of fish schools next week, the price of coffee beans next year. But despite almost 20 years of discussion, apparently widespread misgivings about the advent of computers in the legal world have resulted in the introduction only recently of such basic functions as computerized indexing of cases.

"Some people are supposed to have a computer in their heads, but I don't believe it," Professor Haar said. "Life and the law are very complicated and I don't think anyone can juggle 204 variables in differing combinations in their heads at one time while reviewing all the recorded cases. It's just done better by a machine than by a human machine."

"Of course, this is just a tool and not a Ouija board, you can't just go to the computer and get your answer," he said. "But the combination of the skilled lawyer and a good analytical tool like this will be better than either separately."

According to legal scholars who have studied reports of the experiment in the Bar Foundation's Research Journal this spring, some such computer case analysis may be a tool that will result in more negotiated and arbitrated settlements as each side can more accurately assess its chances of success.

Additional results might include less crowded court calendars, more sharply focused cases as the issues become clearer with the help of the computer, and better legal service, as even the most inexperienced attorney would be able to draw upon more courtroom experience than most lawyers ever get.

About the only drawback they can see, aside from cost, would be the inclination of clients and lawyers to take the computer's advice uncritically, leading to reluctance by some lawyers to take unpromising cases that might break new legal ground.

William Thomas, a research attorney at the Bar Foundation's headquarters in Chicago, called the study "extremely novel."

"What he has done is just nuts and bolts to a computer person, but legally it is really fantastic stuff," Mr. Thomas said. "He is taking all these legal issues and forcing himself to be very specific about them, rather than just talking about truth and beauty and justice, as most lawyers do. It's always been done by intuition before, and what Haar has done is reduce it to variables with a given set of probabilities."

And David Link, the dean of the Law School at Notre Dame University, called all previous research on computers in the law "very rudimentary" by comparison. "With probability theory used like this, a lot of lawyers will save their time and their clients' time by not pursuing some cases and devoting their energies to areas where good law can be made," he said. "The other side of it is that a lot of creativity may be cut off. But like everything else, the really good people are going to use innovations like this really well."

UNCALCULATED RISK

Lloyd's of London, the celebrated insurance exchange, had its beginnings in a bright idea: insuring oceangoing ships. Premiums paid by all the ships, it was reasoned, would more than pay for losses incurred on the few that later sank, and there was practically no danger that many ships would sink at the same time.

A few years ago, some insurance underwriters at Lloyd's tried out another new idea: insuring the fast-growing U.S. computer-leasing industry against revenue losses if the leases were canceled. But in writing perhaps as much as $2 billion of such policies, the Lloyd's experts unaccountably underestimated the possibility that computer-leasing contracts, unlike ships, might well all sink together.

As a result, the possibility of a staggering loss is looming before some of the 361 Lloyd's syndicates, which are owned by about 14,000 well-heeled individuals who usually profit handsomely by pledging their personal wealth against possible insurance claims.

In taking up insurance contracts on computer leases rather than on such customary things as supertankers, the syndicates perhaps could lose as much as $1 billion, some Lloyd's insiders say. Such a total would far exceed the current record loss, the more than $100 million paid out for damages from Hurricane Betsy in 1965.

Only recently, Lloyd's disclosed that it was being sued for almost $600 million in one offshoot of the increasingly complex computer-leasing dispute.

Insurance specialists say the fiasco is especially surprising because the computer-leasing policies broke a Lloyd's tradition going back to the exchange's founding nearly three centuries ago. Rather than insuring against a disaster, the policies insured the leasing companies against ordinary business risk. Michael Burns, an insurance-risk specialist at Marsh & McLennan Inc., the largest U.S. insurancebrokerageconcern, says: "Lloyd's wrote the insurance on equipment where the potential for obsolescence was enormous—yet they wouldn't write the same kind of insurance for railroad cars, machine tools and other equipment with little or no likelihood for obsolescence in an inflationary time."

Indeed, computer leasing is inherently a risky business. Leasing companies borrow money to buy computers; then they lease out the equipment to other companies and repay their debt as lease payments come in. But the typical seven-year lease gives the computer user the right to back out of the lease after the first three years, and in the past many have done so.

The total amount of leasing revenues insured by Lloyd's hasn't been publicly disclosed, and Lloyd's refuses to discuss this and many other aspects of the situation. But one Lloyd's customer, Itel Corp. of San Francisco, disclosed in a credit agreement last year that Lloyd's was insuring $380 million of leasing revenues for that concern's customers alone.

Lloyd's had some misgivings about the insurance from the start; it stopped offering the policies after less than a year and resumed them, in 1976, under terms more favorable to itself.

The man generally said to be responsible for getting Lloyd's into computer-lease insurance is Peter Nottage, of Adam Brothers Contingency Ltd., a specialty broker that often designs unique policies for Lloyd's underwriting syndicates. In London, Mr. Nottage said through a secretary that he has "no comment whatsoever" on the situation.

A Beautiful Way To Interface

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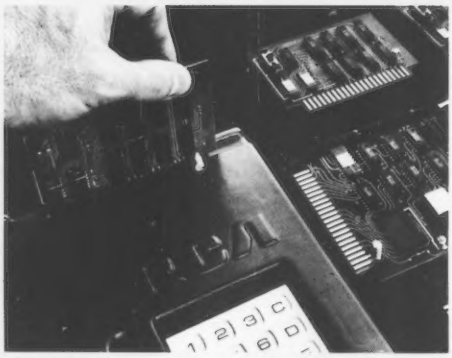

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*Suggested retail price. CDP18S711 does not include video monitor or cassette recorder.

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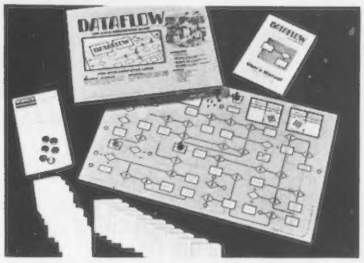
Electronic Games Roundup

Part II

David Ahl, Betsy Staples and Randy Heuer



Dataflow by systems, Inc.

We generally feature reviews of computer hardware and software, but this review is a bit different. It's about a board game entitled "Dataflow." As you might guess, the game has some connection to computers.

"Dataflow's" board resembles a programmer's flowchart. Standard symbols such as rectangular boxes for operations, diamond symbols for decisions and computer card outlines for input statements are employed. Also located on the board are two switches represented by two two-sided plastic disks, and regions for two stacks of cards called Control Cards and Input Cards which are represented by miniature punched cards.

The objective of "Dataflow" is to accumulate more counter (CTR) points than your opponents, and play consists of moving your marker from one instruction box to another. This is done by following the flowchart pathways through the decision symbols taking the specified paths until the next instruction box is reached. You then perform the operation indicated in the instruction box which usually modifies your CTR value.

The strategic portion of the game comes into play before and after you move your marker. During these pre-control and post-control phases you may change switch settings, change the sign of the register or NOP (no operation) instructions by playing control cards. Through these tactics, you may alter or cancel unfavorable instructions for your marker or try to force an opponent into an instruction box unfavorable to him.

As many as four can play and the game ends when there are no more Input Cards remaining and the player with the greatest number of points in his/her CTR is the winner. It is intended for players twelve years and older.

The educational value of "Dataflow" is readily apparent. In addition to teaching flowcharting symbology, the game also provides some insight into computer logic. People with little or no computer background can easily learn to play the game.

It is fun to play although I would not rate it among the top five games I've ever played. With two players, the primary tactic employed is to hold on to all the Control Cards until the last few turns. This tends to make much of the early game inconsequential and an exercise in trying to collect as many Control Cards as possible. A larger board with many more pathways might help overcome some of this stagnation. Although I did not have the chance to play "Dataflow" with more than one other player, I suspect that multi-player versions would be more exciting. In games with three or more people, alliances could be made and broken, and negotiations could play a large role in determining the winner.

For more information on "Dataflow," write to :

Systems, Inc. of Baltimore
300 Hospital Drive
Glen Burnie, MD 21061

Stop Thief by Parker Brothers

Felicia Field, sneak(er) thief, is wanted for disrupting a pro football game and attempting to sell used sneakers through the U.S. mail. Any of four players of Parker Brothers' Stop Thief can apprehend her or any of nine other criminals and collect a reward.

The electronic Crime Scanner provides clues as to where the thief is moving on the playing board--the bank, the furrier, the street or subway--and a roll of the dice enables the player/detective to follow him or her as crimes are committed in any of 19 locations. The first player to collect $2500 in reward money is the winner.

Although the ideas behind the two games are similar, we found Stop Thief much less complicated and easier to play than Ideal's Electronic Detective. Therefore, while it does not provide as great a challenge for an adult, Stop Thief is probably more appropriate for younger players.

Electronic Detective by Ideal

The first thing you see when you open one of Ideal's new electronic games is a slip of paper congratulating you on becoming the owner of an Ideal product and offering assistance through a toll-free hotline. Instituted two years ago, the hotline provides consumers with information on game rules and set up, how to obtain missing parts, where to buy accessories, etc. "Ideal," the note says, "accepts the responsibility of keeping you a satisfied customer" — a good idea, we think.

In Electronic Detective one to four players are private detectives in a race to solve one of 130,000 possible murder mysteries. The game includes a set of 20 cards, each with a name, picture and brief description of a suspect/victim; a computerized Electronic Detective Console; a pad of fact sheets and 19 pages of instructions.

As play begins a LED display on the front of the console reveals the identity of the victim and general location of the body. Players question suspects—some answers are shared with other players and some are private—and record the information obtained on their Case Fact Sheets. The winner is the first player to deduce the identity of the murderer by applying logic using the fairly complicated set of game rules. A player who accuses the wrong suspect is "shot" (a bit of gratuitous violence) and the play resumes.

The game has three difficulty levels and can also be played by one person who wants to sharpen his or her skills. We think that teenagers and adults who have the tenacity to wade through the instructions and memorize the rules will enjoy the game as a challenge to their problem-solving skills.

Head To Head Football by Coleco

Play against the computer or an opponent. The offensive player has directional keys to move the ball carrier up and down the field and laterally, also a run/kick/pass selector. The defensive player has directional keys only to control his main tackler. Action takes place on a ten-yard enlargement of the field, although to score you must move the regulation 100 yards. Players are indicated by LEDs, the brightest ones of which are the ball carrier and main tackle. Lots of sound effects, two skill levels, and quick action make this a favorite with kids of all ages. One of the best.

Electronic Stadium Baseball by L.J.N. Toys

This stadium-size unit (14" x 10" x 4") requires 6 D cells or a battery eliminator to light its bright scoreboard and sound effects. Each player has just two buttons to press: at bat you have a "hit" and "pinch hitter" key; in the field you have a "pitch" and "relief pitcher" key. Unlike other electronic games, strategy is more important than hand/eye coordination. For example, average team players have a batting average of .270 while pinch hitters bat at .400, but you only have three pinch hitters. Not as exciting as some of the other games, but not as frustrating either. Any age can use it.

Atomic Arcade Pinball from Tomy

This ample-size game (9"x16"x5") is powered by five D cells and was a favorite of our panel of kids. It's noisy, making kind of a continuous siren noise while it is turned on in addition to the sound of the ball bouncing against the five "action" bumpers and two flippers. It has a five-wheel digital scoring mechanism that records players' scores. We found that younger players liked to play it with the front propped up to give it less slant (the ball could be kept in play much longer). Older players quickly found out that it had no penalty for tilting, and thus some rather astronomical scores were recorded. There are no real electronics to this game, the batteries are used to power the sound generator, one flashing light and bumper/scoring mechanism.

MVP Pinball by Lewis Galoob

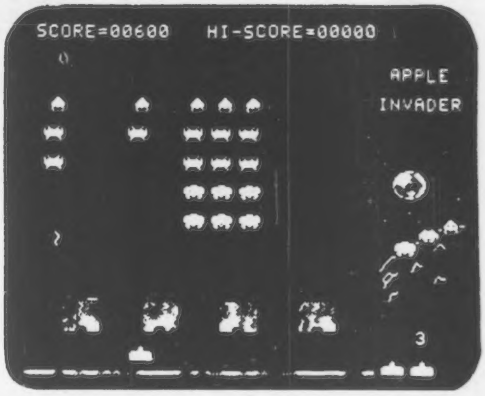
According to the directions, MVP Pinball promises all the thrills of full scale pinball in a hand held game. It features six action bumpers, a flashing red light, flippers, and digital scoring and sounds. If this game has all of the thrills of full scale pinball, then full scale pinball can't be very thrilling. We were not impressed with the game. All too often, the ball went between the flippers without even giving you a chance to hit it. Maybe that is like real pinball. It did make noise, but it's hardly the kind of game that will keep you coming back to it for hours and hours. MVP Pinball is probably suitable for younger children—until the novelty wears off. One thing it does have going for it: it's inexpensive — but it does take four C cell batteries.

Force by Invicta

This interesting (non-electronic) game of strategy turned out to be one of our favorites from this year's crop of board games. Easy enough to be learned by an 8-year old it moves fast and holds the interest of both children and adults.

Each player has two elastic "force lines" that stretch across the board. In the first six moves, each player places pegs in holes to distort his opponents' lines (we found it best to alternate opening moves in contrast to the instructions which states that one player places all his pegs, then the other). Players then alternate turns placing and removing pegs to straighten their own lines and distort those of their opponents. □

For Apple II



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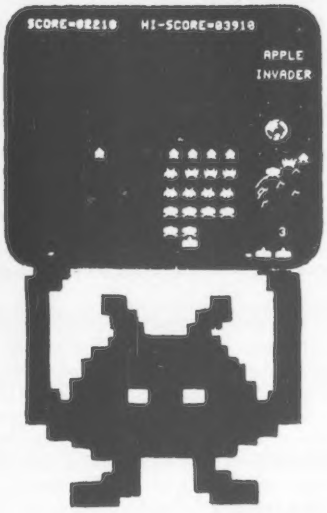

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Betsy Staples

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Craig M100

I first saw the new translators at the Consumer Electronics Show in June. Actually, I didn't get a very good look, since there were always hoards of people crowded around the demonstration models of the Craig M100, but my curiosity was piqued, so I requested an evaluation sample, which arrived about a month later. In the meantime, I learned of the existence of the Lexicon LK-3000, which has, in the interim, undergone a name change and is now known as the Nixdorf LK-3000. I requested and received one of those, too.

The first thing I noticed about both translators was that they are not exactly pocket-size. Perhaps I've just become terribly spoiled by credit card calculators and mini biorhythm machines, but the approximately 6" x 3½ x 1" size and 11 and 13 oz. weight of the machines made it a bit difficult to imagine carrying them around. The M100 comes with a black velvet drawstring carrying bag, and the LK-3000 has a more professional looking brown vinyl case with a zipper closing and room inside for two additional language modules.

The prices of the two machines are comparable: the LK-3000 with one language module and international adaptor/charger retails for $225.00; the M100 with English memory capsule and domestic adaptor/charger sells for $199.00.

Both machines have interchangeable language modules. The Craig's memory capsule contains a 32K memory chip which plugs in the back of the machine and is smaller than a 9-volt battery. Each capsule costs $25.00. The LK-3000 uses a cartridge containing a 64K ROM and a microcomputer which is about the size of a cigarette pack and slides in the bottom of the unit. Its price is $65.00.

The Craig can accommodate up to three languages at a time. The LK-3000 has room for only one. Both machines can translate from English into the foreign language or vice versa.

Having checked out the external specifications of the two translators, I thought an introduction was in order. I checked the phrase list on the back of the Craig, found "Hello" and pressed the appropriate keys ("PHR" and "D"). "Bonjour," it replied when I pressed the French key. Then, "Hola," in Spanish - both appropriate greetings. "H-E-L-L-O" I typed into the LK-3000. "Hello= Allo," it replied. "No, it doesn't," I protested. "'Allo' is used for answering the telephone, not as a greeting," I explained. It refused to reconsider.

Well, everybody knows how to say "hello" in their host country, perhaps a more practical type of experiment would be appropriate. Let's order a meal - a meal that a North American traveler might be likely to order in France. Thinking of my father, a frequent traveler, but a not-too-adventuresome eater, I decided to start with shrimp. No problem; both translators informed me that "shrimp" is "crevette" to the French.

For the main course, I decided to order roast beef. "Roti boeuf" the M100 prompted - not exactly idiomatic, but intelligible. The LK-3000 tried to convince me that "Roast beef=Roast-beef boeuf," but I remained unconvinced. I tried for a steak: "Steak= Steak," it said. That much I (or my father) could have come up with unassisted. Trying to think of something else my father would eat under such circumstances, I tried chicken. Finally, a reasonable response: "poulet." Recalling the myriad ways in which chicken can be prepared, I pressed my luck and asked for roast chicken. "Roast chicken=Roastbeef poulet," said the LK-3000. "Here we go again," I said, and decided to settle for whatever a request for "poulet" would bring.

The greatest value of a translator may lie in its potential as a conversation piece.

In the interest of nutrition and a balanced diet, I next turned to the ordering of vegetables. String beans should be available in a French restaurant, right? The LK-3000 refused to allow me to order string beans, green beans or beans. The M100 told me that bean(s) was "haricot" and green beens "vert haricot." Once again, a bit weak grammatically, but understandable. I tried peas, carrots and beets before discovering that I could order tomatoes with both units.

Perhaps a potato would be nice with dinner. The Craig told me that a potato is a "pomme de terre," but the LK-3000 said "not ound" (by now one of its LED's was out and the definitions resembled a six-year old's smile). It had already determined that rice was the only appropriate accompaniment to any meal in France. The M1000,

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CIRCLE 110 ON READER SERVICE CARD

Translator, con't . . .

while it would not let me specify a baked potato, gave me both rice and noodles as alternatives.

For dessert, both machines gave me an acceptable selection of cake, pie and ice cream, plus coffee and tea. At this point, however, a startling omission in the LK-3000's vocabulary came to light boding ill for ulcer-stricken businessmen: the word for milk is not included!

While the two machines are basically similar with the letters of the alphabet arrayed in alphabetical order (initially somewhat confusing for anyone accustomed to a standard typewriter keyboard) and various other keys which initiate the translating and calculating operations. The characters in the Craig's display are bluish green, and the LK-3000's are red.

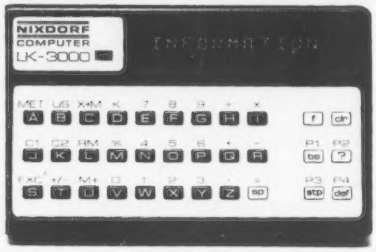
To use the LK-3000, the traveler simply "types" the letters of the word or phrase for which he or she wants an equivalent, presses the "def" key and waits for first the English word and then the French word to travel from right to left across the display. If the word is not in the vocabulary, "Not found" appears immediately.

The only catch is that the user must press the "stp" key after each word or phrase that is contained in the vocabulary. This is fine for single words, but can be frustrating when attempting to translate a phrase or sentence. For example, to translate "What time is it?" if one keys in the question one word at a time, pressing "stp" after each, the result is "Quoi temps es il" - a hodge podge sentence which would probably elicit an answer pertaining to local atmospheric conditions. However, if the user had guessed correctly that the entire sentence was contained in memory and pressed "stp" only after the last word, the correct, idiomatic "Quelle heure est il" would have been displayed.

The M100 can also be used to translate one word at a time, but it has, in addition, a list of 48 phrases and partial phrases that can be entered by pressing only one or two keys at a time. The list includes such useful phrases as "Please," "Do you understand?" "Do you change Travelers' Checks?" and "Bring the bill please." Partial phrases include "Take me to . . . ," "I am looking for. . . . ," "How much . . . ," "I would like . . . ," and "Round trip . . ." The phrases are idiomatically and grammatically correct and contain the conjugated form of the appropriate verb.

An attempt to obtain translations of the same phrases from the LK-3000 produced some comical results. "It's too much," for example, came out "Il est trop beaucoup de" - a phrase unlikely to be understood by any but the most imaginative shopkeeper. Equivalents of other phrases proved impossible to obtain.

Except for those in the Craig's preselected phrase list, all verbs in both machines are given in the infinitive form. The M100 uses "L" as the definite article for all nouns and the LK-3000 uses "le," both of which are intelligible compromises.



Nixdorf LK-3000

The M100 has another very useful feature missing on the LK-3000: to translate a phrase containing a proper noun or other non-translatable word, the user can press the "HLD" key after the word, and the machine will not attempt to translate it. For example, "My name is Elizabeth" becomes "Je m'appelle Elizabeth" as opposed to "Not Found."

Both translators allow the user to scan their vocabularies a word at a time. The scanning process may be stopped at any time to allow the user to check the translation of a given word. This feature could be handy for locating synonyms when the word desired is not in the vocabulary.

It seems unlikely that either of the translators could allow a person totally unfamiliar with a foreign language to actually speak the language, but the communication gap could be bridged by simply showing the machine with the appropriate word or phrase displayed to the other person. The LK-3000 provides a guide to pronunciation in the instruction booklet that accompanies each language module. The Craig Corporation promises a new module that will provide pronunciation assistance on the translator itself.

As for other modules, the LK-3000 offers English to Spanish, French, Italian, German, Polish, Portuguese, Greek, Swedish, Russian and Japanese languages; a Personal Program which "turns the LK-3000 into a personal data bank; and modules containing records and statistics for all winter and summer Olympic events. Capsules currently available for the M100 include French, German, Italian, Spanish and Japanese.

Both translators can also be used as calculators. The M100 has the calculator feature built in so that the user need only press the "EXT" key and begin entering numbers. The calculations are, however, quite slow and accompanied by much flickering of the display. The LK-3000 requires that a separate, but much quicker, cartridge be plugged in before it can be used as a calculator.

Both translators also come with adaptor/chargers. The LK-3000 has an international adaptor/charger which can be changed from 120v to 240v by setting a switch. The Craig M100, rather shortsightedly, comes with only a domestic adaptor/charger. The overseas version must be purchased separately.

And the traveler would be well-advised to purchase the additional adaptor/charger, since both machines lose their charges very rapidly, giving way to flickering nonsense on their displays.

In making an overall comparison of the two translators, the Craig M100 comes out ahead because it seems to have more features which allow the traveler to produce reasonably correct, idiomatic phrases in the foreign language. The person who entered the French translations for the LK-3000 apparently did not have the command of language that one would expect. I found too many mistakes and omissions for comfort. I also found it quite tedious to wait while the entire word or phrase and translation chugged across the display.

In conclusion, is the hand-held electronic translator a significant improvement over a $5.00 paperback dictionary of about the same dimensions? Probably not. It is certainly an entertaining toy, but as a real communications tool, it has a long way to go.

Does that mean that it is of no value and ought to be ignored by the traveler? Not at all. It is quite possible that an electronic translator might give a timid traveler sufficient confidence to try something new instead of throwing up his or her hands and heading for the nearest Intercontinental Hotel. However, I think its greatest value lies in its potential as a conversation piece (albeit an expensive one). What better way to strike up a "conversation" with a local resident than by showing him a machine asking for directions? □

TRY GAMES MAGAZINE JUST FOR THE FUN OF IT

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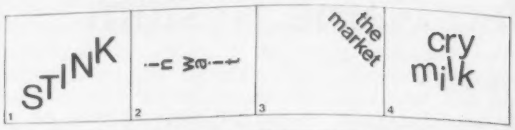
Wacky Wordies

The object is to discern a familiar phrase, saying, cliche, or name from each arrangement of letters and/or digits.

For example: belt hitting illustrates "Hitting below the belt."



Call Our Bluff

Truth often being stranger than fiction, below we have confused the real world with the imaginary by providing equally bizarre examples of both. Your task is to figure out which of the animals is real and which is not.

The Tarsier is a five-inch long relative of man, related by its opposable thumb, big toe, and relatively large brain. Like the owl, the Tarsier is able to look completely backwards over either shoulder.

The Midgeon is a small boneless tropical fish, considered a delicacy by many. It is nicknamed Camelfish for the double raised ridges or "humps" along the spine.

Eyeball Benders

What are these objects?

a. The gleam in your eye.

b. Pass the word.

Scotchograms

The object is to send extra words in a telegram without paying for them. For example, to send the following message: "Cannot come on account of my old man being sick in bed with a stomach ache," you would be charged for 16 words unless you wrote it more or less phonetically (saving 5 words): "Cannon come anaconda mold man being sicken bed with atomic ache."

1.
I THINK YACHT TO EVADED AWHILE.

2.
WHAT SUMATRA JAVA FIGHT.

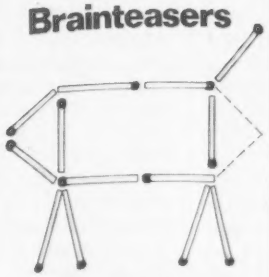
3.
DIMENSION IT OLD PSYCHIC UTAH DUNDEE SAME FOR ME.

4.
LOVE ENCASES FOREIGN ICE GIRL.

5.
ARTISAN JAIL AGAIN WORMY ALIMONY YUKON TO BALAAM OUT.

6.
SAHARA WING EXPERIENCE ALRIGHT.

Brainteasers



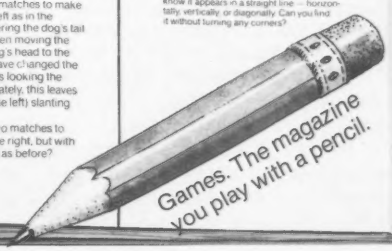
Arrange thirteen paper matches to make a dog that faces to the left as in the diagram above. By lowering the dog's tail to the top dotted line, then moving the bottom match of the dog's head to the other dotted line, you have changed the picture so that the dog is looking the opposite way. Unfortunately, this leaves the dog's tail (now on the left) slanting down instead of up.

Can you move just two matches to make the dog face to the right, but with his tail pointing upward as before?

Beguilers

Y	O	N	O	M	O	O	N	E	
E	O	N	E	O	O	N	E	M	
Y	E	N	E	N	O	M	Y	O	
O	O	E	E	E	O	M	N	N	
Y	E	Y	O	N	M	O	N	N	
E	Y	M	E	N	O	M	O	E	
N	C	Y	E	N	N	O	M	Y	
M	E	N	E	Y	O	N	O	M	
M	Y	E	Y	O	M	N	O	M	

We lost our MONEY in the letter grid above. We know it appears in a straight line — horizontally, vertically, or diagonally. Can you find it without turning any corners?



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ANSWER DRAWER: **Wacky Wordies**: 1. Raise a big stink 2. Lying in wait 3. Corner the market 4. Cry over spilt milk. **Eyeball Benders**: a. Toothpaste tube b. Telephone cord. **Scotchograms**: 1. I think you ought to have waited a while. 2. What's the matter, did you have a fight? 3. Don't mention it, old sidekick, you'd have done the same for me. 4. Love and kisses for a nice girl. 5. Art is an jail again, wire me all the money you can to bail him out. 6. It's a harrowing experience alright. **Call Our Bluff**: The Midgeon is a phony. **Beguilers**: MONEY begins in the third row, seventh column, and reads diagonally downwards. **Brainteasers**

APF MP 1000 Video Game System

Randy Heuer

Several manufacturers of home video game units have, in recent years, introduced so-called "programmable" games that use interchangeable cartridges. Owners of these units have the advantage of being able to play several different games simply by switching game cartridges. One of the latest of these units is the MP 1000 from APF Electronics. A further advantage of the MP 1000 is that a keyboard expansion is promised from APF to convert the game into a full-fledged personal computer, "the Imagination Machine."

The MP 1000 is relatively small. The base unit measures 11½″ × 7″ × 2½″. The molded housing is fairly attractive with its flat black finish and woodgrain trim. On top of the unit are slots for the hand-held controllers, reset and power switches and the slot for inserting the optional game cartridges.

The hand-held controllers are about 4″ × 2½″ × 1½″. Each is attached to the main unit by a six foot cable. The controllers are very well designed. On top of the controller is a twelve key numeric keypad (0-9, CLEAR and ENTER) and a joystick-like lever. The rear side of the controller contains a large, red button, labeled "FIRE" which can easily be pressed by the index finger of the hand holding the controller while the other hand manipulates the keypad or joystick. This controller can easily be operated by hands of all sizes and was obviously well thought out by APF.

Power to the unit is supplied by a transformer that plugs into the standard 117 V wall outlet, eliminating the need for a supply of fresh batteries. The unit connects to any TV through a TV-game switchbox, so owners need not constantly switch antenna wires. On a color TV, the game displays will appear in color, and game sounds are produced through the TV's speaker.

The base unit comes with one game built-in entitled "Rocket Pilot." The display in this game consists of a field of stars that move across the screen in one direction while enemy spaceships move across the screen in the opposite direction. This gives the impression of looking out the side window of a moving spaceship, watching the enemy spaceships fly by and is an extremely successful effect.

Unfortunately, compared to the graphic display, the game itself is somewhat disappointing. The object of the game is to destroy the enemy ships by firing a slow-moving missle from the bottom of the screen. This turns out to be a skill which can be mastered very easily. Since the enemy ships do nothing in retaliation, the game is not much more than a slow-paced shooting gallery.

Optional Program Cartridges

We received six plug-in cartridges with our review model of the MP 1000. These are apparently the only cartridges available at this time although more will probably be available in the near future.

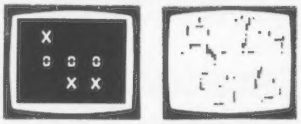
Cartridge MG 1001 is entitled "Catena." Most people will recognize this game as the popular board game "Othello." Players alternately place pieces of their color on a 64 square board, capturing pieces by surrounding rows of their opponent's pieces.

The graphics used to display the board and pieces are nicely done and the game plays fairly quickly, although some people may find the constant beeping as pieces are "flipped" a bit obnoxious.

Three variations of the game are available: two player, one player versus the computer and computer versus computer. I found the computer's play to be slightly disappointing. It passed up several good moves during the few games I played and I beat it quite easily every time. I'm still not too sure just what strategy the machine employs, but I suspect that it simply takes the most pieces it can in any turn. However, people who enjoy "Othello" will appreciate having an opponent available whenever they wish to play.

The second cartridge, MG 1003 is entitled "Hangman/Tic Tac Toe/Doodle." Up to four players can play "Hangman." Players may enter their own word or let the computer select one from its list of three to ten letters.

To guess a letter, players enter a two digit code from the hand-held controllers. The list of codes is displayed on the right side of the screen and codes are eliminated from the list as each letter is selected. If you fail to guess the word on the final guess, the floor drops from beneath the hangman figure and the correct word is displayed. Graphics and sound in this game are particularly well done and children should enjoy this game.



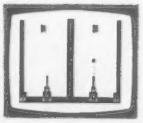
"Tic Tac Toe" can be played by either one or two players. "Doodle" lets you draw patterns on the screen in any of the nine colors using large size graphic blocks.

Video Game, con't . . .

The Bowling/Micro Match cartridge, MG 1004, contains a total of eight games. Each game may be played by one to four people. There are five variations of the Micro Match game. Essentially, this is a copy of the TV game show Concentration. A game board containing 24 numbered squares is displayed on the screen. Hidden behind each square is an object or word. Players alternate turns, selecting two (or three) squares. If the objects behind the squares selected match, the player receives a point and those squares are eliminated. The game ends when all the squares have been matched and the player with the most points is the winner. In two versions you must match two squares. In the remaining three versions, three squares must be matched in order to receive a point.

In Bowling, the bowling alley and pins are displayed on the screen. The ball moves back and forth across the alley. To roll the ball, the player presses the fire button when he feels the ball is in the right position. The ball will then procede down the alley and strike the pins. Scoring is the same as in real bowling, spares, strikes and three ball tenth frames are allowed. Three different variations of the game are available, from easy to difficult.

Cartridge MG 1005 is entitled "Brickdown/Shooting Gallery. "Four versions of "Brickdown" are available. In this game, one player tries to knock down a wall of bricks using nine balls. The player keeps the ball in play with a paddle controlled by the joystick. The player may choose between slow or fast speeds and an eight or twelve layer wall.



In "Shooting Gallery," one or two players try to hit five targets which move rapidly back and forth. Bullets are fired by pressing the fire button on the controllers. As each target is hit, it's replaced by a smaller, faster target. Three versions are available, each with a different number of bullets per round.

Clearly, the finest cartridge of those presently available is "Baseball," MG 1006. You may compete against either another player or the computer. This game is nearly identical to the version seen in many coin-operated arcades. It uses a higher resolution display than some of the other cartridges and features a full playing field and complement of players, a scoreboard, offensive players that run the bases and fans seated in the grandstands. The defensive player positions his outfielders and controls the direction and speed of the pitch. The offensive player decides when and if to swing the bat. After three outs, the team on the field runs into the dugout and then the other team runs on the field. The only small complaint I have is that the defensive player can't move his fielders after the ball is pitched, but, in all other respects, this game is the best version for a home video game I've seen.

The MG 1007 cartridge features three variations of the card game "Blackjack." Each version is similar except different betting limits are imposed. One or two players bet against the house which is played by the computer. Doubling and insurance are allowed and good graphics and audio features add to the game.

Finally

Judging from APF's initial investment in the MP-1000 system, many more cartridges should be available in the future. In general, the cartridges presently available feature good graphics but the computer strategies employed could be better. Still, most kids will enjoy the games now available and will take pride in beating the machine.

APF has also announced that a keyboard unit which plugs directly into the MP 1000 console will also soon be available transforming it into "The Imagination Machine." We'll have more about this in the months ahead.

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The New Surprises From Heath

Eric Van Horn

The Heath Company recently announced that, in addition to its electronic and computer kits, it will move into assembled systems for the business computer market. Not only is this a unique activity for Heath, but their approach to software and applications represents a new direction for a microcomputer manufacturer. We have not had a chance to use the new computers yet, but for you skeptics who are giggling at the thought of Benton Harbor BASIC, read on. This is not just a stab at another unconventional business system, nor is it merely an update of the H-8.

The WH11A mainframe, the "heart" of the new Heath Data Systems minicomputer system, uses the 16-bit DEC KD11 HA CPU and comes complete with heavy-duty power supply, backplane and cabinet. Fully compatible with the PDP 11/03, the WH11A offers power, speed and flexibility. The system includes RX 01 compatible dual floppy disk storage, 32K words of memory and two serial I/O interface cards.

Heath's new hardware starts with the WH19 video terminal. The WH19 is an intelligent Z-80 based terminal which features a 25 x 80 character display, relative and direct cursor addressing, and normal and video reverse display options. Interfacing is via a standard RS-232 interface with DIP switch programming for Baud rates of 110 to 9600, full and duplex communication modes, parity selection and word length. A numeric key pad and software selectable functions round out the WH19's capabilities. The new terminal is competitively priced at $995.

Add a second Z-80 chip, memory and a 5¼" disk drive and you then have the WH89 desktop computer. The WH89 comes with 16K of RAM which can be expanded up to 48K. There is also room for two RS-232 serial I/O ports. Heath is initially offering three software packages, an operating systems disk, Microsoft BASIC and word processing. Benton Harbor BASIC is still available on the operating systems package, presumably so you can run the old H-8 software, but the availability of Microsoft BASIC should be popular among users and programmers alike. The operating systems disk also provides a text editor, assembler, console debugger and a set of disk utility programs. The WH89 will retail for $2295.

Probably the most interesting system in Heath's new repertoire is the WHS11A. The WHS11A uses the DEC KD11-HA CPU with accompanying dual 8" disk drives. It is, from both a hardware and software standpoint, completely compatible with the DEC PDP-11/03. Those of you familiar with the PDP-11 know that Digital uses a language called DIBOL for most of its business applications programs. DEC, however, would not

WHS11A minicomputer system consists of the WH11A mainframe (shown in lower right of cabinet); the WH19 microprocessor-based "smart" video terminal (left desktop), and the WH27 dual-drive floppy disk system, (upper cabinet shelf). The system is fully compatible with the DECR PDP11/03.

Surprises, con't . . .

license Heath to use DIBOL, so they went elsewhere and obtained the rights to DIBEX, a DIBOL compatible language. The DEC compatibility not only makes a lot of software available for use with the WHS11A, it opens a whole new market for Heath with the numerous DEC OEM's around the country, especially at the list price of $6,289.

Although Heath Company will use its 55 stores as repair centers, do not look there for their new systems. The WH89 and WHS11A will be marketed through retail stores with Computerland and Byte Shops leading the way,

The Heath Data Systems WH89 is a totally integrated microcomputer system contained in a compact, desk-top terminal that supplies all of the computing power needed for most small business or professional tasks. It is shown here with cover removed.

and also through OEM's particularly those now handling DEC equipment.

The big question is whether a kit manufacturer can make this kind of transition to complete business systems. The manufacturing capabilities, hardware and software support, and marketing techniques required could not be more different. But there is little doubt that the WHS11A in particular offers the kind of power and price performance that is going to be hard to beat. For more information on Heath's new products write to:

Heath Data Systems
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CIRCLE 121 ON READER SERVICE CARD

In which we tell the naked truth and lose all our printer advertisers.

On Buying a Word Processing Printer and Other Good Fun

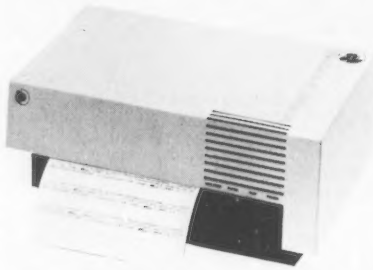
David Ahl and Steve North

Introduction

Sometime in mid 1978, we decided that we really ought to be making better use of microcomputer technology at Creative Computing. While we had 24 microcomputers in our Software Development Center and many more in employees' homes, virtually none were used in the business or administrative end of the company.

Obviously word processing was a likely area in which to use micros. After all, we had reviewed eleven systems on our pages; it was about time that we used some in our own work.

We decided to put together several generalized CP/M and 6800 hardware configurations on which we could run different software systems. While we already had several suitable computers, video boards, floppy disks and keyboards, we had little in the way of suitable printers. Hence, putting ourselves in the shoes of a typical small business (we are one!), we bought six representative printers. In particular, a low, mid and two high end dot matrix printers and mid and high end impact printers.



Integral Data IP 125

We bought our IP 125 from Jade Computer Products and received immediate (2 week) delivery. We chose a friction feed unit so it could handle letterhead, and a parallel interface because we had several boards with unused parallel ports. But what we quickly learned is that "parallel port" is rather loosely defined and differs sharply from one manufacturer to another. It took the services of a real hardware jock to finally get the printer to play on a SWTPC 6800.

The IP 125 works well, has been reliable, and is a good buy. We have not given it a severe workout yet since our office employees have become addicted to Electric Pencil (note to compufreaks: the correct rendition of this name is "Pencil." To use the full term "Electric Pencil" merely reveals to all present that you are a Mere Neophyte and not one of the Beautiful People of the Computer Priesthood.) Consequently said employees have not, to their own disadvantage, learned the TSC 6800 text editor and heavily used the IP 125.

Although the IP 125 is a dot matrix printer, the output is of sufficient quality for correspondence, and we'd recommend it as a good value for personal use.

Teletype Model 43

While the Teletype Model 28 and 33 were the workhorses of the data communications industry for years,

Computer	Sample Print
Integral Data IP 125	The quick brown fox jumped over the lazy dog.
Teletype Model 43	The quick brown fox jumped over the lazy dog.
Texas Instrument 810	THE QUICK BROWN FOX JUMPED OVER THE LAZY DOG.
Malibu 165	The quick brown fox jumped over the lazy dog.
Selectraterm	The quick brown fox jumped over the lazy dog.
Qume Sprint 5	The quick brown fox jumped over the lazy dogs. The quick brown fox jumped over the **lazy dogs.**

Good Fun, con't . . .

with the '43,Teletype had embarked on an entirely new technology (dot matrix printers) which was proving at the time (1976) to be a real stumbling block for Digital Equipment Corp., the giant minicomputer manufacturer with their ill fated LA30. Since then DEC has gotten its act together, but fortunately the folks from Skokie, with Ma Bell closely watching their child, had their act together from the start.

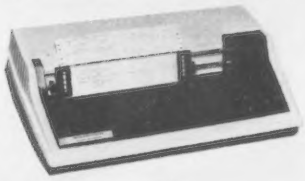
The Teletype '43 is, quite frankly, the most reliable mechanical device we have ever seen. It simply goes and goes. We replace ribbons and supply it with paper but it has never had a single adjustment or been out of service. We use it to check out every computer we get because we can always be certain that the I/O device is working correctly. We gave up keeping records on it after it had passed 1000 hours of service. It is probably nearing 3000 hours by now.

The only preventive maintenance it has received was when a cup of coffee was spilled into it. We turned the '43 upside down to pour out the coffee and then took it apart and cleaned up the remainder. An hour later and it was back in service.

Got a hankering for a Peterbilt? Try a Teletype 43. Not beautiful print, but rugged and reliable.

Disadvantages: It is a dot matrix. You won't want to send out your letters to customers printed on this one. Even worse it requires a "funny" 12" width paper. The idea is that it can print 132 columns (13.5 characters per inch) sideways on a sheet; you strip off the perforations and you've got an 8½ x 11 sheet that can be easily copied or filed. Nice idea and it works fine for program listings, articles and the like, but not for correspondence. Third problem: three years after introduction there are still very few second sources for paper or ribbons and, unless you've got a Western Electric office in your vicinity, that could be a headache. Fourth: the tractor feed width is not adjustable — you're stuck with the odd 12" paper. However, we've found that the left tractor alone will drag single width labels through as long as you look at the box every so often to make sure nothing is binding.

Summing up: for rough drafts, memos and internal reports the Teletype '43 is a best buy.



Texas Instruments 810

We bought this one from Micro Mail in Santa Ana, Calif. and received prompt (3 week) delivery when "authorized" TI dealers in our area were quoting 6 months delivery or charging premium prices, $2200 plus, for speedy delivery.

We bought this shortly after the 810 was announced. Prior to buying it we called TI's much advertised hot line (phone number given in all the 810 ads) to get information. Wall, the lady with the Taxas drawall hadn't even heard about the ad and she just couldn't imagine who might have the information we wanted. Four lengthy, much routed phone calls in as many weeks got us not one single piece of verbal or printed information out of TI and it was not until we saw TI and MicroMail at NCC in Anaheim in person that we got any details on the printer. We liked what we saw and ordered the receive-only version on the spot. (The version with a keyboard is the Model 820).

When the printer came from Micro Mail we did not test it, until we repaired a Vista disk system. (Vista had just changed hands and the new management disowned our disk drives, which came already prebroken to enhance unplanned downtime. We are proud to own the Studebaker of disk drives.) By the time we discovered the TI 810 had come with a bad CPU cord, the warranty had expired (deja vú) we were beginning to lose faith in the term "assembled and tested."

Once the bad CPU cord was replaced, the TI 810 worked almost flawlessly. (Every 10 or 20 hours a molex connector buried deep within the printer's innards comes loose, creating very unreadable printouts.

The TI 810 was our choice for a printer for our business accounting system (still in implementation stage. Another hint: Osborne CBASIC software does not a turnkey system make.) It's a very fast printer - we run ours at 9600 baud with handshaking although the effective speed is probably half that. It's also quieter than the other dot matrix printers we have (Malibu and Centronics).

Despite our problems (which we suspect are the exception rather than the rule), we still think the TI 810 is an excellent choice for a medium-duty printer for business applications at a reasonable price.

Malibu 165

The Malibu boasts some design features that really attracted our attention when we first saw the unit at the Percom show in March 1977. In particular: adjustable tractor, user-definable characters, graphics capabilities, bi-directional printing and a manufacturer that seemed to really care about the personal computer industry. We ordered a unit direct from Malibu; delivery took an agonizingly long five months.

The Malibu is like a Gartlis dragster: a winner for certain specialized applications but overkill for daily commuting.

The Malibu's main attraction is that the host computer can have absolute control over the firing of print hammers, carriage control, etc. This is useful for printing computer portraits, sheet music, or high-resolution displays. For normal unadorned text editing or report printing it's a bit of a drawback because a 4K assembly language driver has to be entered

Manufacturer/Model	Print	Speed	Price
Teletype Model 43	Dot matrix	30 cps	$1095
Integral Data IP125	Dot Matrix	100	$799
Texas Instruments 810	Dot Matrix	150	$1895
Malibu 160	Dot Matrix	165	$2395
Selectraterm	Impact	15	$2190
Qume Sprint 5/45 KSR	Impact	45	$2995

Good Fun, con't . . .

from the manual and debugged just to make it print ordinary text. Coincidentally, Malibu sells an RS-232 intelligent interface so the Malibu can function as a normal serial printer. Consider, for a few extra dollars, you can buy an option to circumvent the special features for which you already paid another few extra dollars. A revolutionary breakthrough!

Seriously, for exotic printing applications the Malibu is tops. For everyday, crummy printing the Malibu is not as fast or quiet as the TI 810, and more expensive. Still, it hasn't required any service to date.

Selectraterm

Selectraterm, originally Selecterm, now called Selectra-Print is an IBM Selectric II typewriter modified by Micro Computer Devices, Inc. into a terminal device. This is not an IBM data communications terminal, rather it is a standard office electric typewriter into which six electromechanical solenoids have been installed with a separate box (7" x 7" x 3") containing the interface electronics.

A tour of the plant by President Shelly Howard and the knowledge

that this was the only terminal device "approved" by IBM (i.e., IBM would service the typewriter part of the mechanism) convinced us that this was the terminal to get among the many Selectric-based units on the market.

Four months after our order was placed and still without a terminal, we weren't so sure. It finally arrived, but without one cable. Phone calls. Letters. Another month.

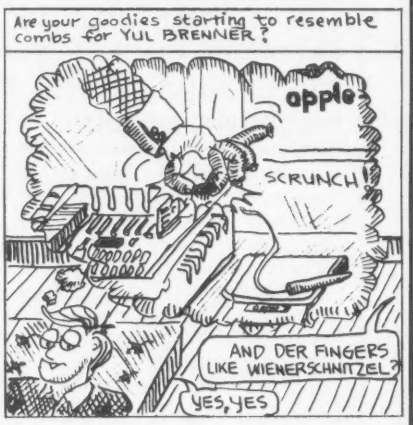
However, once hooked up, Selectraterm worked fine. It produced letter quality material, and could be used in local mode as an electric typewriter. Although not a tractor feed device, Selectraterm can be used with both continuous feed as well as single feed paper.

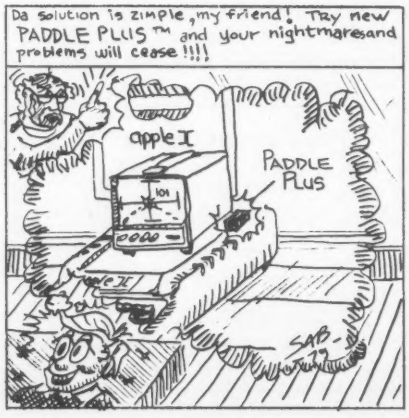
But, unfortunately, once it went into constant duty, Selectraterm faltered. At 42 hours a new solenoid was needed. We called MCD who told us that the closest supplier supposedly was in Chicago but they were unwilling to process an order for less than 500 pieces. (It must be nice to be in that position). However, we found that Blan Electronics Distributors in New York, NY had it and they sent it to us via priority mail. We then had to figure out how to install it to finally get back in business. Why are we telling you this? What happened to the much-touted IBM Service? As you might have guessed, the problem was not in the IBM mechanism and IBM wouldn't touch it (after charging $43 to tell us that!). What if we hadn't been able to disassemble the machine and replace the part ourselves? What indeed?

In summary: the Selectric II is a good solid office typewriter mechanism. The add-on solenoids and electronics of MicroComputer Devices are well designed and the result is a good terminal for low to medium duty. However, it is not designed for continuous duty nor will it stand up under it.

We join ARNOLD ZIEBACK in the office of the world reknown DR. ANDREW GATES, CS* .... ARNOLD has been having some nightmares lately .....
WHAT ZEEMS TO BE DE PROBLEM ?
I'VE BEEN PLAGUED BY PADDLE PROBLEMS!
AH... P.P.
* COMPUTER SCHIZOPHRENIA

Ah. yes, good ole P.P., stemming down from BRIGHT PENS, joysticks, & paddles... covers ON and OFF, IN & OUT.....
HEY! ARNOLD... I GOT IT OUT!!
BRIGHT PEN
SOFTAPE
YES
I SUSPECT SYMPTOMS OF "HELPFUL" FRIENDS .... DA??





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Qume Sprint 5

One thinks twice before spending as much on a printer ($3000) as the rest of the computer system combined. However, we wanted one no-compromise, first class unit and the Qume seemed to be the best choice. State-of-the-art, built-in microprocessor, bi-directional printing, tractor or single feed, on-line or manual operation and much more. So we ordered a keyboard, Sprint 5 Model 45 from Computer Textile in Los Angeles.

(Sneak preview: If you're willing to go first class on the purchase price, be prepared for first class maintenance prices too.)

Our printer, arrived in short order (3 weeks), but sans print wheel and ribbon. A visit to 2M Corp. in Fairfield, NJ yielded the missing parts, under warranty, and we were in business. But not quite. Erratic operation was traced to a loose board. The rubberized clip holding the boards in place leaves something to be desired. A call to Qume yielded the advice, "Take out the boards, reseat them firmly, replace the clip, and it ought to work." It did, but it's a half hour disassembly/reassembly job.

The Qume sat around a while waiting for a disk drive to arrive and, unfortunately, by the time the system was all hooked up the 120-day warranty period had expired. (DON'T LET THIS HAPPEN TO YOU!)

After 10 hours of operation, the print quality suddenly deteriorated

If you like the Jaguar XJS, you'll love the Qume Sprint 5. Fast, fickel and expensive to maintain.

and by 10.5 hours, a loud 300 hertz hum came from the printer head drive motor and the print head was advancing completely erractically. By this time we had come to really "depend" upon the system and we needed it fixed quickly. Ha! Gotcha!

Qume had by this time (August 1979) set up a service center in New Jersey but the conditions for service were as follows:

1. No on-site service. Bring in the unit and they'll look at it for $50 plus $60 "handling" for us to bring it in the front door.
2. Normal turnaround is a minimum of 30 days unless one pays an additional $50 for 3 working days expedited service.
3. Payment must be made with a certified check. Company check or even cash is not acceptable.

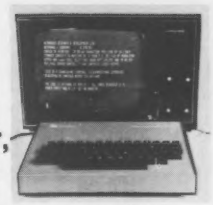
We called Data Access Systems, a Qume OEM; Sorbus Service (recommended by Qume); and 2M, the previous Qume agent, but none of them were any longer willing to provide a guaranteed service in light of Qume having their own service center in Upper Saddle River, NJ (a one-hour trip for us). So we bit the bullet and paid $160 just to bring the printer for repairs after less than 11 hours of use. It turned out to need an I.C. (TL084), two 1087 F.E.T.s, and two capacitors ($65.00 worth of stuff!) — hard to believe after only 11 hours of use. But to compound matters Qume claimed we had a faulty cable (the one that came with the unit and was working fine) and charged us $42.00 for a new one. To really cap the situation, when we first got the unit, it had a small crack in the cover which we had repaired with Crazy Glue (sounds silly, but it worked fine). The Qume service people didn't like our fix so they removed the cover piece that we had glued on. Unfortunately that piece held the paper guide so now we have a printer sans paper guide that frequently eats the documents it is printing. The total bill was $217.05 (paid by certified check) and the unit now is semi-operational. The service carries a 30-day guarantee, for what that's worth.

The Qume is a beautiful unit and has outstanding print quality. Type face and pitch may be easily varied and the unit handles continuous feed paper as well as single sheets. Allegedly it may be used in local mode although we found that the ribbon often jumps out of alignment when typing manually. Operating at the full rated speed on-line seems to be much more to its liking.

In summary: The Sprint 5 is a finely tuned piece of machinery, much like an Italian automobile, and will probably need service sooner than you might imagine. Qume is oriented to selling to OEMs and not to end users. If you buy a Sprint 5 make sure you have a good local arrangement for service because the manufacturer is not the least bit cooperative with individual end user customers. If this is the treatment that we as a respected major international magazine receive, just imagine how you might be treated. □

By Netronics

ASCII/BAUDOT, STAND ALONE



Computer Terminal

COMPLETE FOR ONLY . . . $149.95

The Netronics ASCII/BAUDOT Computer Terminal Kit is a microprocessor-controlled, stand alone keyboard/terminal requring no computer memory or software. It allows the use of either a 64 or 32 character by 16 line professional display format with selectable baud rate, RS232-C or 20 ma. output, full cursor control and 75 ohm composite video output.

The keyboard follows the standard typewriter configuration and generates the entire 128 character ASCII upper/lower case set with 96 printable characters. Features include onboard regulators, selectable parity, shift lock key, alpha lock jumper, a drive capability of one TTY load, and the ability to mate directly with almost any computer, including the new Explorer/85 and ELF products by Netronics.

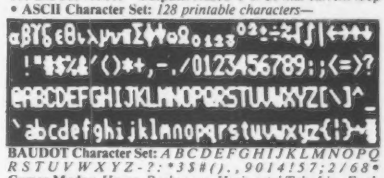
The Computer Terminal requires no I/O mapping and includes 1k of memory, character generator, 2 key rollover, processor controlled cursor control, parallel ASCII/BAUDOT to serial conversion and serial to video processing—fully crystal controlled for superb accuracy. PC boards are the highest quality glass epoxy for the ultimate in reliability and long life.

VIDEO DISPLAY SPECIFICATIONS

The heart of the Netronics Computer Terminal is the microprocessor-controlled Netronics Video Display Board (VID) which allows the terminal to utilize either a parallel ASCII or BAUDOT signal source. The VID converts the parallel data to serial data which is then formatted to either RS232-C or 20 ma. current loop output, which can be connected to the serial I/O on your computer or other interface, i.e., Modem.

When connected to a computer, the computer must echo the character received. This data is received by the VID which processes the information, converting to data to video suitable to be displayed on a TV set (using an RF modulator) or on a video monitor. The VID generates the cursor, horizontal and vertical sync pulses and performs the housekeeping relative to which character and where it is to be displayed on the screen.

Video Output: *1.5 P/P into 75 ohm (EIA RS-170)* • **Baud Rate:** *110 and 300 ASCII* • **Outputs:** *RS232-C or 20 ma. current loop* • **ASCII Character Set:** *128 printable characters—*



BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # ( ) . , 9 0 1 4 ! 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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☐ **Video Display Board Kit** alone (less keyboard), **$89.95** plus $3 postage & handling.

☐ **12" Video Monitor** (10 MHz bandwidth) fully assembled and tested, **$139.95** plus $5 postage and handling.

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CIRCLE 172 ON READER SERVICE CARD

Satellite Tracking Software

Randy Heuer

If you've ever watched a satellite race across the sky at twilight and wished to know its identity, or if you've ever wanted to track a satellite, then you might want to investigate the satellite tracking package developed by Sat Trak International. This package consists of three separate tracking programs available on disk or tape for the Apple II, TRS-80 and Exidy Sorcerer. Listings in BASIC and FORTRAN are also available.

For review purposes, we tried the Apple disk version, STI-9C0B which runs in Applesoft II and comes with a 20-page instruction manual. In addition to the three standard tracking programs, this package includes t additional programs for maintaining a data base for as many as fifty satellites. The price of this version is $48.50.

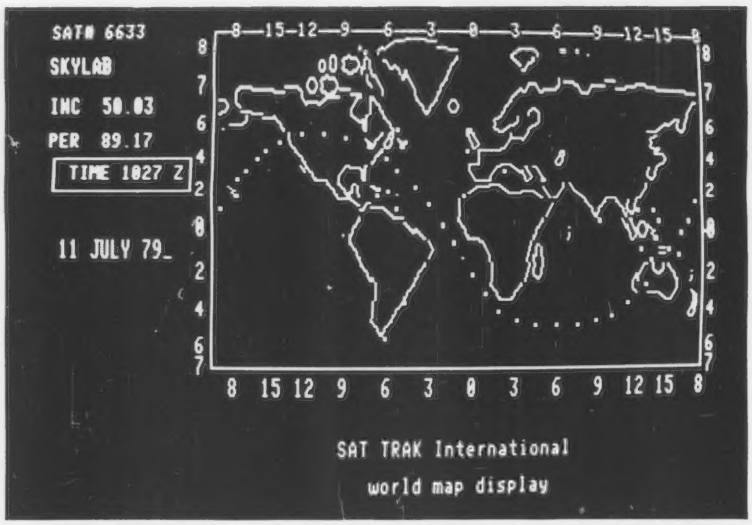
Each of the three tracking programs requires an accurate satellite data base that must be updated regularly. A program for making these updates is included with each package. Data for making updates are available free of charge from NASA or you can generate your own parameters from satellite observations and the OBS program. This program uses your own observations of the satellite to update satellite parameters as satellite orbits decay with time.

The remaining two programs are used to determine the position of the satellite of interest. Program POSN calculates the orbital location of the satellite, providing an ephemeris of geodetic latitude, east longitude and altitude. Some versions of this program also calculate right ascension and declination.

The LOOK program is used to generate "look angles" for satellites from your location. Values provided by the program include azimuth, elevation, right ascension, declination and range to the satellite. In addition, the user may place certain restrictions on the output such as maximum range, visual passes only and maximum elevation.

The versions of the programs that we tested were well adapted for the Apple II computer. Features such as waiting for a user prompt when the screen is filled help to make the programs very user oriented. The instruction manual, although highly technical, attempts to explain the concepts to users new to the field of astrodynamics. Still, I think most new users will need to consult an additional reference on the subject in order to get maximum benefit from the programs.

Although not intended for everyone, those individuals with a need or interest in satellite tracking (such as Ham radio operators), will find this package outstanding. For further information on programs and prices, write to: Sat Trak International, c/o Computerland of Colorado Springs, 4543 Templeton Gap Road, Colorado Springs, CO 80909. □



A new program soon to be released by Sat Trak is called Trace, shown here in development form on a 32K Sorcerer.

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SysKit: A Modular Program Development Tool

Jim Rosenberg

An objective, and rather negative, evaluation of a program development system for North Star... and a response from the programmer/author.

SysKit, by William LaForge, Jr. (marketed by Interactive Microware, Inc. P.O. Box 771, State College, Pa. 16801), is an unusual product. It is offered as a "tool kit" for those who might want to design their own operating systems for the 8080. What SysKit provides is a system for writing programs in small modules, linking them together, relocating them and also a memory management scheme so that blocks of memory can be allocated and released dynamically. SysKit does not provide an editor or assembler, relying on whatever assembler the user already has. What it does provide is the support software for managing modules once they have been created.

Background on Modular Programming at the Machine Level

There are many reasons why modular programming is highly desirable. If software can be designed so that a large program is put together from small pieces, each of which can also be used in other programs, then a lot of duplication of effort is avoided. The smaller the pieces can be made the easier they are to design and debug. Modular software is often much easier to modify than software that is not modular, since many times only one or two modules need be modified. In addition, a modular approach to software can create a very healthy atmosphere of competition in the marketplace, since different software vendors could compete with modules that perform a similar function, analogous to the current market in hardware.

Jim Rosenberg, RD #1, Box 236, Grindstone, PA 15442.

There are two fundamental requirements for modular programming. First, there must be a way to either avoid or resolve conflicts among modules. Second, there must be a way for the modules to communicate with each other, without knowing the details of how each is designed. The most difficult source of conflicts among modules at the machine language level concerns the problem of relocatability: two machine language programs may conflict in the use of memory addresses. This will require one or both of them to be moved, or relocated. Many microprocessors, such as the 6502 and 6800, have relative branch instructions. This means that branches are not made to a specific location, but to a location relative to wherever it currently is in the program. If the program is moved to a different place in the memory, the branch instruction does not have to be changed. This would be analogous to having a statement in BASIC that would GOTO the statement n lines up or down in the program from the current statement.

What SysKit provides is a system for writing programs in small modules, linking them together, relocating them and also a memory management scheme so that blocks of memory can be allocated and released dynamically.

Alas, the 8080 has no relative branching. In 8080 machine language, every branch instruction must branch to a specific place in the computer's memory. If the program is to be put in a different place in memory, these addresses will have to be changed. Even for those microprocessors that do have relative branching, in many cases changes must still be made when a program is to be relocated. Often, for instance, a constant must be used as an address. If the program is moved, this constant must also be changed. How does the system know what information must be changed if a program is to be moved in the computer's memory?

Modular software is often much easier to modify than software that is not modular, since many times only one or two modules need be modified.

Relocation Schemes

The subject of relocation schemes is a difficult one when you get into all of the arcane details. At least two software vendors, Xitan and Microsoft, have high quality software systems for solving this problem. In simple terms, each module includes not only the instructions and data comprising the program, but also specific "extra" information telling exactly what things need to be resolved when the module interacts with other modules. Included in this information is an explicit indication of every address that must be changed if the program is to be moved. Communication with other modules is achieved by retaining some information in symbolic form. Thus modules can be given names, and a module can define a name as a "public symbol" for other modules to use. To call a subroutine in a different module, the symbolic name of that subroutine is indicated as an "external symbol" (external to the module in which it occurs).

Note that this system involves two parts. First, there is a convention for the format of modules, stating

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exactly how the information is to be presented regarding values to be relocated, symbols to be made public and references to external symbols. Second, sophisticated pieces of software create this information, and then use it to combine modules into programs. A Relocating Assembler will compile this "extra information" automatically, while a Linking Loader or Linkage Editor uses the information to construct combined programs from separate modules. The user need not even be aware of the presence of this information, since it is handled automatically by the software.

The SysKit Relocation Scheme

Given these general considerations, how does SysKit stack up? LaForge, the author of SysKit, is to be praised for having his heart in the right place and for having a grasp of the problems that need to be dealt with in a modular approach to software at the machine language level. I wish I could be as full of praise for the actual implementation as presently offered. Unfortunately, the kindest thing I can say about SysKit is that it is idiosyncratic in the extreme. Let's look at the relocation scheme. The real thorn of a problem in relocation schemes is the method of specifying just which bytes in a program need to be changed when a program is put in a different place. Both Xitan and Microsoft have attacked this problem in the proper way: their conventions for the "extra information" needed in a module include data that specify explicitly where the bytes are that must be resolved.

Modules can be given names, and a module can define a name as a "public symbol" for other modules to use.

LaForge's approach is to use a trick to indicate this information implicitly. His astonishing proposal is that a number be banished! The modules which are to run in the SysKit system are to be assembled so that the actual instructions in each module begin at EDOOH. (The suffix "H" denotes hexadecimal.) Each module is limited to 255 bytes in length — actually 237 to be on the safe side. The number EDH, or 237, is simply prohibited from appearing in any module except as the high order byte of an address. Thus, whenever EDH appears in a module, the SysKit linking routine knows that it must represent the high order byte of an address, and so it and the preceding byte are automatically resolved. (For the 8080 the high order byte of an address goes at the higher address in memory.)

The idea of simply banishing a number from appearing as a constant in any program is an amusing joke if done in the context of one's own software, but to offer it as a serious standard and hope that other software designers will adopt it is so ludicrous that it's painful. What if EDH happens to be the low order byte of a key address within a ROM somewhere? Out of luck. You would have to perform some shenanigans such as using EEH and then decrementing. Obviously, the choice of EDH was made in part because EDH happens to be one of the few of the possible 256 bytes which are not 8080 op codes. But what about the Z80? EDH just happens to be one of the key codes which extend the Z80 instruction set beyond 256 op codes. For Z80 users this choice is not a joke, it's a disaster. It would appear that SysKit is completely unusable on a Z80.

The author of SysKit, is to be praised for having his heart in the right place and for having a grasp of the problems that need to be dealt with in a modular approach to software at the machine language level.

Modules are limited in length to 255 bytes in order to insure that a unique one-byte value, the prescribed EDH, will always appear as the high order byte of every address. Problems can occur in fact if a module is longer than 237 bytes, since EDH might have to appear as the low order byte in an address, rather than the high order byte. While there are advantages to working with modules as small as possible, I find myself balking at having an arbitrary limit imposed on the length of a module. If a module just happened to want to be 260 bytes long instead of 255, it would be infuriating to have to split it into two modules, a structure that would not reflect its internal logic, simply in order to conform to LaForge's odd restriction.

What about intermodule communication? In LaForge's system each module has to have a one-byte identification number. A module is called by putting its number in the A register, then calling a central SysKit routine via a RST 1 instruction, which sends the call to the place where the module has been put. Modules are linked into place and relocated by other entry points into SysKit. This method is fine if linkage between modules is simply restricted to the procedure for calling another module, but it does not handle the problem of linking data from one module to another in the more general way permitted by a full scheme of public and external symbols.

When the relocation / linkage scheme of SysKit is compared to serious attempts to solve these problems, SysKit measures up very poorly. Perhaps it's too strong to say that SysKit is a turkey, but I can hardly imagine it being a tool of choice among microcomputer software designers. There is often a tradeoff between the sophistication of the software required to support modular programming and the extent to which the user may have to forego using some of the resources of the computer. SysKit comes down on the "budget approach" side of this tradeoff with a scheme that is more like the

While there are advantages to working with modules as small as possible, I find myself balking at having an arbitrary limit imposed on the length of a module.

SysKit Memory Management and Other Features

On the other hand, there is work in SysKit that could be quite useful if packaged in a more sensible scheme. SysKit includes routines to dynamically allocate and release blocks of memory. This means that when a program needs a data area, rather than having this area be fixed by the structure of the program, the program can simply ask the system for the amount of storage it needs. When the storage is no longer needed, the system is called again to release it. kind of quick and dirty expedient a casual homebrewer would take to avoid having to write a difficult piece of software, than what we would expect from a professional product offered for sale.

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There are many important areas of systems programming, such as re-entrant or recursive programming, where some type of dynamic memory allocation is simply mandatory. Memory management at the machine language level is missing from almost all microcomputer software, and it is sorely needed. LaForge's dynamic memory allocation routines seem to work successfully. I haven't given them an exhaustive test, since to be honest about it I have no intention of building a stable of modules around his restrictions, but, on the basis of experiments performed, using some simple assembler programs and the SysKit "software front panel," they appear to be a decent piece of work.

The SysKit software front panel allows hexadecimal values to be entered for the registers and flags. This is adequate, but again does not measure up to software already in the field, such as the CP/M DDT. (CP/M is a trademark of Digital Research.) The SysKit manual, which is only fair, includes the complete source code. Some 8080 users might find the algorithms useful.

In conclusion, LaForge has some good ideas, as well as some very bad ones. If he would apply his energies to providing memory management in the context of a relocation scheme which places no more restrictions on the programmer than does the orthodox approach, he might have a very attractive product. As it stands, SysKit is not a usable product for serious software designers.

There is often a trade-off between the sophistication of the software required to support modular programming and the extent to which the user may have to forego using some of the resources of the computer.

Response From William LaForge, Jr.:

I would like to compliment Jim Rosenberg on his review of SysKit. It is obvious that Mr. Rosenberg invested a considerable amount of time studying SysKit, even though he finds it "idiosyncratic in extreme." SysKit does indeed use non-traditional methods; there is, however, a rationale behind them.

I agree with Mr. Rosenberg that Microsoft's approach (I'm not familiar with the Xitan software) is a "proper" development tool for modular programming. I disagree, though, with his implication that theirs is **the** proper one.

For one thing, the Microsoft linkage editor requires a disk drive. Although the SysKit release evaluated by Mr. Rosenberg runs on disk systems using the North Star DOS, SysKit does not require a disk drive to support modular programming. In fact, SysKit is now available on cassette tape for Level II TRS-80's with 16K.

As the TRS-80 is Z80 based, it is obvious that Mr. Rosenberg is wrong in stating that, "It would appear that SysKit is completely unusable on a Z80." There is, I admit, a slight conflict, in that SysKit modules cannot, as SysKit is distributed, use the EDH op-code. But a one-byte change to SysKit frees the use of EDH (by exchanging EDH for any other value).

The linkage "trick" is indeed a tough nut for programmers of big computers to swallow; Mr. Rosenberg is no exception. But SysKit's "budget approach" to modular linkage yields some appreciable benefits. First, the code supporting it occupies only 120 bytes (78H bytes for you hexadecimal freaks). That leaves plenty of memory to spare for your own programs. Another major advantage of this linkage "trick," when used with the dynamic memory management, is the ability to replace, delete, or add a module to an up-and-running program. Other linkage editor programs relink all modules each time a minor change is made. This ability to update a program makes the development of a large program on a cassette-based system practical. The ability to alter the Input/Output modules, in particular, greatly simplifies the problem of moving a finished program from one computer to another. This is indeed a useful capability!

True, modules are limited in length. But with SysKit's dynamic memory management, no memory is wasted when a module is replaced with another module which is smaller than the original, or when a module is deleted. The dynamic memory management also makes possible the replacement of a module with another which is larger than the original.

Inter-module communication is more versatile than Mr. Rosenberg believes. SysKit does not restrict linkage "simple...to the procedure for calling another module" but, through the use of the linkage table, provides for over 200 FORTRAN-like NAMED COMMON areas. These areas, unlike FORTRAN-like NAMED COMMON areas, may be built or allocated dynamically. Because data areas can be built dynamically and because these areas may be passed by address, the manipulation of data structures and the communication of data between modules is, in fact, one of the strengths of SysKit.

LaForge's dynamic memory allocation routines seem to work successfully.

In his review of SysKit, Mr. Rosenberg bemoans the fact that the dynamic memory is not a part of a more traditional product. Because of the transportability of SysKit, this is not a real obstacle. CP/M, for example, is 100% compatible with SysKit in principle; I just haven't had the opportunity to write a CP/M version of SysKit — yet.

Mr. Rosenberg quite correctly points out that, "SysKit does not provide an editor or assembler, relying on whatever assembler the user already has." I am sure Mr. Rosenberg would agree that anyone programming in assembler has a satisfactory program-development package. Who needs two? I suspect that the people who have a TRS-80 and who are interested in buying SysKit already have TBUG. Great! The cassette version of SysKit is fully compatible with TBUG. The software front panel included in SysKit — though it can be used as a monitor if necessary — is designed for checking the register values passed between modules and for simulating modules which have not yet been written; the software front panel is an important tool for top-down program development.

SysKit does take a non-traditional approach to program development; at every level of the design, the goal was to broaden the scope of the home computer without adding to the cost. Rather than shoehorning a "proper" technique into a microprocessor, new techniques have been developed which are useful and relevant. SysKit provides a set of new and unique tools to assist the serious programmer in developing large programs when he has access to only modest hardware. If you have further questions concerning SysKit, please write to me at Box 410, Boalsburg, Pa. 16827. □

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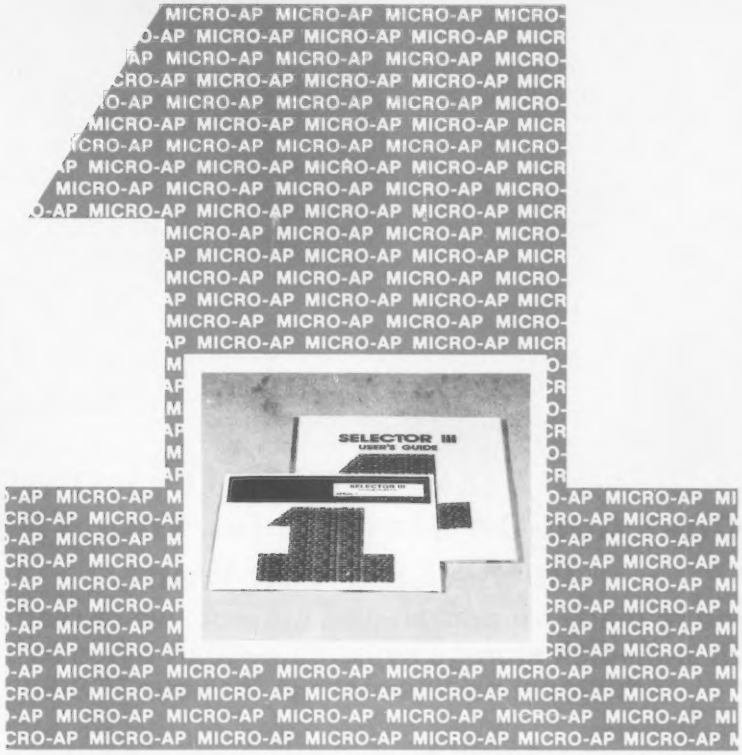

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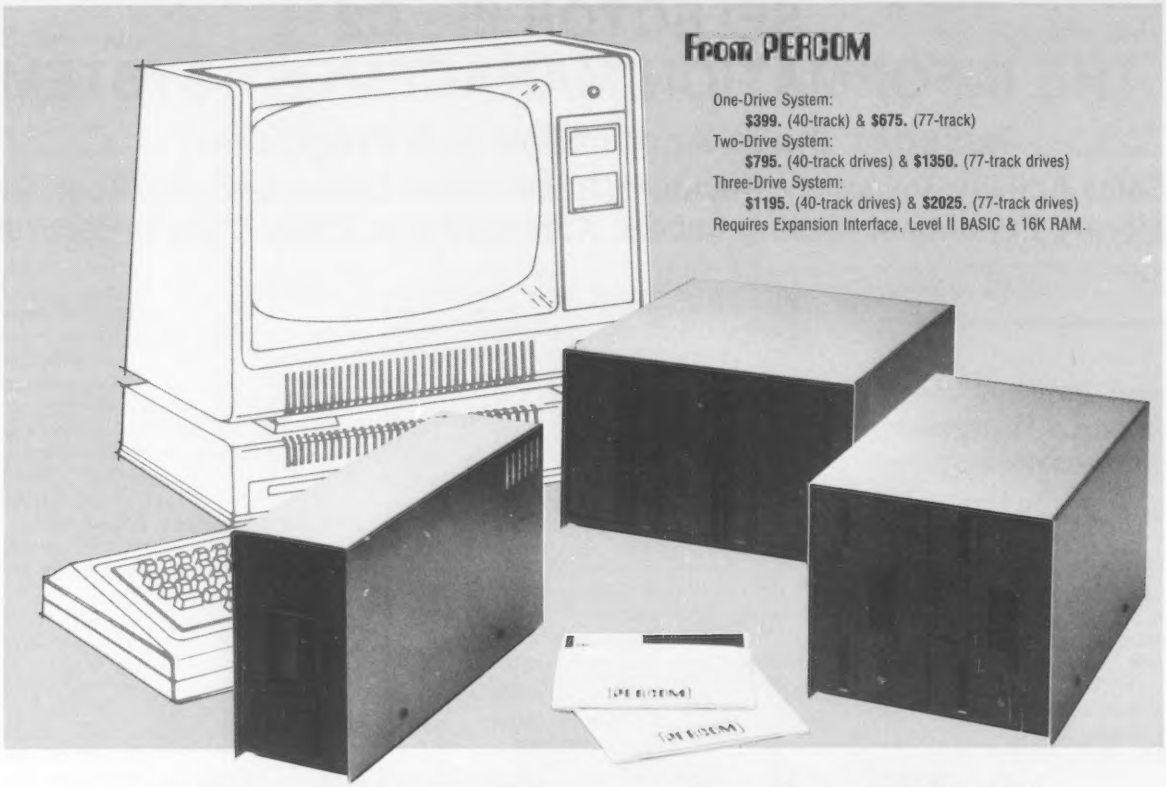
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Battle of the Assemblers

Rod Hallen

In spite of the ease and glamour of programming in BASIC, Pascal, or some other high level language, there still seems to be a lot of interest in assembly language programming. There are probably many reasons for this: first is the challenge involved, next is the smaller memory requirements of an assembly language program and, finally, programs written in assembly language execute much faster than those written in a high level language.

One definite drawback to ALP (assembly language programming) is its difficulty. However, a good assembler can go a long way toward helping make the job easier. This article won't be a tutorial on assembly language programming but rather a description and comparison of two of the more popular assemblers. It is assumed that you have or intend to get some experience with ALP.

The two assemblers we will be comparing are ASM from Digital Research and ASMB from Technical Systems Consultants (TSC). Please see Table 1 for addresses and ordering info.)

ASM is a part of the CP/M Disk Operating System which is available for $100 from:
Digital Research
P.O. Box 579
Pacific Grove, CA 94950

The CP/M version of ASMB is available for $40 from:
Technical Systems Consultants, Inc.
P.O. Box 2574
W. Lafayette, IN 47906

Table 1: Digital Research has many other CP/M systems software packages for sale. TSC, in addition to ASMB, has text editors, word processors, and other software for CP/M, 8080, and 6800 microcomputers. Contact them for more information.

Everything discussed will pertain to the Digital Research CP/M (Control Program/Microprocessor) Disk Operating System which is available for almost every 8080 or Z-80 based microcomputer in both full size and mini disk formats. I selected CP/M for my system because it is by far the most popular of the many disk operating systems on the market, which means that a large amount of software is available for it. A good source is the CP/M Users Group at 164 West 83rd Street, New York, NY 10024. They have a long list of software for sale at prices which are little more than the cost of a blank diskette.

Rod Hallen, Box 73, Tombstone, AZ 85638.

ASM

When you purchase the CP/M DOS, you receive the Digital Research assembler called ASM as part of the package. This is an Intel - Processor Technology compatible assembler and I have been using it for about a year with good results.

One advantage of an assembler is that it is not necessary to look up the machine code for each of the mnemonics in the source list. An even greater advantage is the ability to reassemble a program at any desired address. And, finally, you can insert instructions into the middle of a program and not have to completely reassemble it by hand.

The ASM manual assumes that you have some ALP experience. If you don't, then "8080/8085A Assembly Language Programming" by Lance Leventhal, published by Osborne and Associates, is highly recommended. It can be found in most computer stores.

Assembly Language source listing files for ASM are written using ED which is the CP/M text editor. In a companion article called the "Battle of the Word Processors," I described how ED works. The TSC text editor "EDIT" can also be used to prepare source code for ASM.

Files intended for input to ASM should have the file type ASM, such as TEST.ASM. Assembly is accomplished by entering "ASM TEST" as a Command line. ASM will default TEST to a file type of ASM and anything else will be rejected. You can also specify in the Command line which disk the source code is to come from and where the output of the assembler is to go.

There are two results of a normal assembly. One is a new disk file which is named TEST.HEX. This is the assembled object (machine) code in Intel hex format. TEST.HEX is not directly executable software. It is processed by the CP/M LOAD program which produces TEST.COM. Thereafter, just typing TEST will cause it to be executed like any other CP/M Command (which is the definition of the COM file type).

One advantage of an assembler is that it is not necessary to look up the machine code for each of the mnemonics in the source list.

The second result from an ASM run is a disk file titled TEST.PRN. PRN is the CP/M file type for a print file. This indicates that the contents of the file consists of ASCII characters which are directly printable. TEST.PRN is a combination of TEST.ASM, the machine code in hex which ASM generated, and the addresses in hex where the machine code will be placed. Figure 1 is a printout of the ASM, HEX and PRN files for a simple program.

If ASM encounters anything that it can not evaluate during assembly, it will print an error code and the line involved. Error codes pertain to improper labels, expressions and data. You can also specify in the Command line that you do not want a HEX or PRN file generated, in which case ASM will quickly run through the ASM file looking for errors and printing error messages.

Please note that the file name chosen is completely up to the operator but that the file types ASM, HEX and PRN will always be as shown.

Source files can also be entered in free form, which means that it is not necessary to format the file strictly by column as is shown in the ASM file in Figure 1. TEST.ASM could also have been written as shown in Figure 2. Although this is much harder to read, the resulting machine code will be the same.

Numeric constant input to ASM can be in binary, octal, decimal, or hexadecimal form. These are identified

Assemblers, con't . . .

by a B, O, D, or H following the number and they can be intermixed within the source file. If none of them are used, ASM will assume that the constant is a decimal number.

ASM will also support conditional assembly which allows you to state conditions that will determine the machine code that is generated. Conditional code is enclosed between an IF (expression) pseudo op code and an ENDIF pseudo op code. If the expression equates to a non-zero value, then all mnemonics between IF and ENDIF will be assembled, otherwise they will be ignored. This is similar to the IF . . . THEN . . . structure which is familiar to BASIC programmers. Conditional assembly makes it easy to write complex programs that can be assembled to suit various conditions.

This brief, but fairly complete, description of Digital Research's ASM mnemonic assembler has touched all of the high points. After a discussion of TSC's ASMB, we'll compare the two.

```
                    TEST.ASM

        ;THIS IS AN EXAMPLE OF A SIMPLE PROGRAM WRITTEN FOR
        ;INPUT TO AN ASSEMBLER.  THIS WILL PRINT THE CONTENTS
        ;OF MY CHARACTER GENERATOR ROM ON THE SCREEN.
        ;
                ORG     100H    ;PROGRAM START ADDRESS
        KEYIN   EQU     1       ;CP/M CHARACTER IN FUNCTION
        CONOUT  EQU     2       ;CP/M CHARACTER OUT FUNCTION
        BDOS    EQU     5       ;CP/M DOS ENTRY POINT
        ;
        REPEAT  MVI     D,32    ;INITIALIZE CHARACTER CODE
        PRINT   MOV     E,D     ;GET CHARACTER
                MVI     C,CONOUT;LOAD CHARACTER OUT FUNCTION
                PUSH    D       ;SAVE CHARACTER CODE
                CALL    BDOS    ;SEND TO SCREEN
                POP     D       ;RESTORE
                INR     D       ;INCREMENT CHARACTER CODE
                MOV     A,D     ;MOVE TO A FOR TEST
                CPI     7EH     ;END OF ROM
                JNZ     PRINT   ;DONE? IF NOT GET ANOTHER
                MVI     C,KEYIN ;LOAD KEYIN FUNCTION
                CALL    BDOS    ;AND TEST KEYBOARD
                CPI     3       ;CHECK FOR CONTROL C
                JNZ     REPEAT  ;DO IT ALL AGAIN
                JMP     0       ;GO BACK TO CP/M
        ;
                END

        ;
        :100100001620 5A0E02D5CD0500D1147AFE7EC20209
        :0E0110000 10E01CD0500FE03C20001C3000078
        :00000000000

                    TEST.PRN

                    ;THIS IS AN EXAMPLE OF A SIMPLE PROGRAM WRITTEN
                    ;FOR INPUT TO AN ASSEMBLER.  THIS WILL PRINT
                    ;THE CONTENTS OF MY CHARACTER GENERATOR ROM ON
                    ;THE SCREEN.
                    ;
0100                        ORG     100H    ;PROGRAM START ADDRESS
0001 =              KEYIN   EQU     1       ;CP/M CHAR IN FUNCTION
0002 =              CONOUT  EQU     2       ;CP/M CHAROUT FUNCTION
0005 =              BDOS    EQU     5       ;CP/M DOS ENTRY POINT
                    ;
0100 1620           REPEAT  MVI     D,32    ;INITIALIZE CHAR CODE
0102 5A             PRINT   MOV     E,D     ;GET CHARACTER
0103 0E02                   MVI     C,CONOUT;LOAD CHAR OUT FUNCTION
0105 D5                     PUSH    D       ;SAVE CHAR CODE
0106 CD0500                 CALL    BDOS    ;SEND TO SCREEN
0109 D1                     POP     D       ;RESTORE
010A 14                     INR     D       ;INCREMENT CHAR CODE
010B 7A                     MOV     A,D     ;MOVE TO A FOR TEST
010C FE7E                   CPI     7EH     ;END OF ROM
010E C20201                 JNZ     PRINT   ;DONE? GET ANOTHER
0111 0E01                   MVI     C,KEYIN ;LOAD KEYIN FUNCTION
0113 CD0500                 CALL    BDOS    ;AND TEST KEYBOARD
0116 FE03                   CPI     3       ;CHECK FOR CONTROL C
0118 C20001                 JNZ     REPEAT  ;DO IT ALL AGAIN
011B C30000                 JMP     0       ;GO BACK TO CP/M
                    ;
011E                        END
```

Figure 1: The file TEST.ASM was created with the CP/M ED text editor. TEST.HEX and TEST.PRN are output files from the ASM assembler. Note that the PRN file is the same as the ASM file with the addition of addresses and object code. This program displays the ASCII codes between 20H and 7EH and then stops. Tapping any key will cause it to run again, while a Control C will take you back to CP/M.

ASMB

In general, everything that I've said about ASM applies to ASMB as well. Programs written for input to ASM will be accepted and assembled by ASMB except that ASMB does not support conditional assembly. ASMB has, in addition, some deluxe features that enhance its use. ASMB will run in a 16K CP/M system (with a reduction to the Symbol Table storage area).

Numeric constant input to ASM can be in binary, octal, decimal, or hexadecimal form.

It is not necessary for the input file to ASMB to be file type ASM. In fact, you have complete control of the input and output file names and types.

If you are a software hacker who likes to modify programs in order to make them fit your particular desires, you'll appreciate the complete ASMB source listing included in the instruction manual. It's too bad that TSC didn't put the source on the system disk as well. Information on where to find various control codes, so they can be changed if desired, is also given.

Just out of curiosity, I ran the source code in Figure 1 through both assemblers. ASMB was a few seconds slower but that may be because it asks two questions before it starts to assemble. The first is, "DELETE EXISTING OBJECT FILE (Y-N)?" and the second is, "DELETE EXISTING PRN FILE (Y-N)?" If there are no existing HEX or PRN files with the same file name then the question will not be asked. ASM automatically deletes existing files without asking.

Conditional assembly makes it easy to write complex programs that can be assembled to suit various conditions.

In normal operation ASMB sends the PRN file to the screen rather than to a disk file but there is a run-time option that will create PRN on the disk the same way that ASM does. You can also decide whether you want the addresses and machine code to be listed in the PRN file in octal or hex.

ASMB will assemble source files that are larger than the amount of RAM available by paging the source through memory, assembling as it goes. Perhaps ASM will do this but the manual doesn't say anything about it and I

```
;THIS IS AN EXAMPLE OF A SIMPLE PROGRAM WRITTEN FOR
;INPUT TO AN ASSEMBLER.  THIS WILL PRINT THE CONTENTS
;OF MY CHARACTER GENERATOR ROM ON THE SCREEN.
;
 ORG 100H ;PROGRAM START ADDRESS
KEYIN EQU 1 ;CP/M CHARACTER IN FUNCTION
CONOUT EQU 2 ;CP/M CHARACTER OUT FUNCTION
BDOS EQU 5 ;CP/M DOS ENTRY POINT
;
REPEAT MVI D,32;INITIALIZE CHARACTER CODE
PRINT MOV E,D;GET CHARACTER
 MVI C,CONOUT;LOAD CHARACTER OUT FUNCTION
 PUSH D;SAVE CHARACTER CODE
 CALL BDOS;SEND TO SCREEN
 POP D;RESTORE
 INR D;INCREMENT CHARACTER CODE
 MOV A,D;MOVE TO A FOR TEST
 CPI 7EH;END OF ROM
 JNZ PRINT;DONE? IF NOT GET ANOTHER
 MVI C,KEYIN;LOAD KEYIN FUNCTION
 CALL BDOS;AND TEST KEYBOARD
 CPI 3;CHECK FOR CONTROL C
 JNZ REPEAT;DO IT ALL AGAIN
 JMP 0;GO BACK TO CP/M
;
 END
```

Figure 2: This is the same program as TEST.ASM of Figure 1 except that no attempt was made to place the Labels, Mnemonics, and Comments in neat columns. Both ASM and ASMB will accept source listings that are written this way.

have never tried it. However, I don't believe it will.

Every assembler has to create a Symbol Table in which it keeps track of the value or address of each label in the source listing. As it makes its second assembly pass through the source, it assigns the proper value or address to each label encountered. As an added feature, ASMB prints the Symbol Table at the end of the PRN file. Figure 3 shows the Symbol Table for our TEST.ASM of Figure 1.

ASMB normally assigns 8K of RAM for Symbol Table storage which is enough for 800 to 900 labels. That is an awful lot of labels and, if you are running a very small CP/M system, it will not leave the assembler much room to do its job in. ASMB will still page the source through memory but it runs much slower if it doesn't have much RAM to work with. Information is given in the manual which will allow you to reduce the size of the Symbol Table storage area.

Programs written for input to ASM will be accepted and assembled by ASMB except that ASMB does not support conditional assembly.

If the source file of Figure 2 is input to ASM, the PRN file will look the same with the addresses and machine code in front of each line. However, if Figure 2 is input to ASMB, the PRN file will automatically be columnated as shown in Figure 1. Or, if desired, this feature can be turned off.

ASMB also has title and paging options. When these are specified in the source listing, the PRN file will be printed in page form with a title and page number at the top of each page and a form feed at the bottom after a selected number of lines have been printed. This is a nice feature but I have a PRINT.COM file that I got from the CP/M Users' Group which does the same thing and it is not necessary to include any paging information in the source list itself. PRINT is used instead of TYPE as a CP/M Command with the output going to the LIST device.

Another option that relates to printing is Selective Page Outputting. This allows the programmer to specify in the Command line which pages of the assembled listing he wants printed. Assembly will proceed normally but only the selected pages will be printed. There will not be a Symbol Table listing and error messages for pages that are not printed will be lost. Assembly can be stopped temporarily or exited at any time with the use of the Escape and Control C keys.

HEX files produced by ASMB can be made into COM files by way of the CP/M LOAD Command as long as they Originate at 100H. For programs that Originate at some other address, ASMB provides special assembly and loading procedures.

ASMB can produce binary files (file type BIN) instead of Intel format HEX files. These BIN files can be assembled at any address above 290H. Two routines are included with ASMB that will load and optionally run BIN files.

One of these routines is called GET and if you type "GET file name," that file will be loaded into memory at its starting address. The other is called LGO and if you type "LGO file name," that file will be loaded into memory and it will be executed. In order for LGO to know where to start executing, an execute address is appended to the program Pseudo OP END. For instance: if the last line in a program says, "END 0C900H," C900H will be the execute address.

Unfortunately, since both GET and LGO operate between 100H and 290H, no program can be loaded below 290H. However, I have a short routine from the CP/M Users' Group that loads programs down to 0000.

Conclusions

As you can see, ASMB has a number of useful features that ASM does not. Just to recap, these include: a complete assembler source listing, assembly of ASM files that are larger than memory, listing of the Symbol Table and loading and executing of programs at any address above 290H. While I previously programmed around CP/M's requirement that programs start at 100H, I still find this latter feature very useful.

Every assembler has to create a Symbol Table in which it keeps track of the value or address of each label in the source listing.

Both the ASM and ASMB manuals are well done but I think the ASMB manual is easier to read. This may or may not be a valid opinion because I first came to the ASM with little assembly language programming experience. By the time I got ASMB I knew a great deal of what it was trying to teach me.

Since ASM comes with CP/M and ASMB costs $40, you will have to decide whether the features described

```
SYMBOL TABLE:

BDOS   0005   CONOUT 0002   KEYIN  0001   PRINT  0102
REPEAT 0100
```

Figure 3: This is the Symbol Table for TEST.ASM that ASMB appends to the bottom of the PRN file. Note that the assigned value or address for each Label in the program is shown.

Assemblers, con't . . .

above are worth that much to you. Since I have both on hand, I use ASMB to do all of my assembling for me. For those of you who are not running CP/M, TSC has many different 6800 and 8080 versions of ASMB on magnetic and paper tape. Contact them for more information.

There isn't any doubt that a good mnemonic assembler makes the programmer's job easier and, therefore, more enjoyable. I hope I have convinced you of that and helped you decide which one to use.

Assemblers Addendum

Since writing the above evaluation I've had a chance to try another 8080 assembler. This one is called SASSY and is available from Midwest Micro-Tek, P.O. Box 29411, Brooklyn Center, MN 55429 for $75 on full size single or double density CP/M disks and North Star mini-floppys. SASSY is advertised as the "8080 Super Assembler."

SASSY's manual leaves something to be desired. It assumes much more information than it provides. In a slim 18 pages it is just not possible to provide more than a brief summary of its features. The experienced assembly language programmer won't have any problems but the novice will have to look elsewhere for answers. Also, the manual is printed with what appear to be computer readable characters. Unfortunately, I can't read the strangely shaped characters as well as a computer can.

SASSY will accept most but not all source files that have been prepared for CP/M's ASM assembler. That is due to the fact that some of my source files are written in lowercase which is entirely acceptable to ASM or ASMB but not to SASSY. This is a minor problem that is easily solved when writing new source files.

What features qualify SASSY for the "Super" title in its advertising? It

ASMB has a number of useful features that ASM does not.

will process multiple files for one thing. If the Command Line contains the following: "ASSM TEST, TEST1, B:TEST2 to TESTX," SASSY will assemble TEST, TEST1 and TEST2 into one program named TESTX. Disk drive designations are permissible with all file names. This multiple file linking is a step toward macro capability.

It will also generate a Symbol Table similar to ASMB's and in addition it will create a Label Cross Reference Table. This table lists all of the labels and their values and it also shows each location in the program where they are used. These tables provide very valuable information to the programmer.

Page, length, width and title can be included in the source file and they will control the format of the print file when it is listed to the printer. I like this feature and my only complaint is that the titling doesn't start until the second page. Probably because SASSY doesn't encounter the Title Directive until after the heading for the first page has been printed.

SASSY has two features that I have a major problem with. Print files and error messages are always sent to the list device. If you don't have a printer, you can't implement SASSY. When I first started using SASSY, it kept getting hung up. It took me awhile to figure out that it was trying to send error messages to the printer which wasn't turned on.

I would much prefer to have the error messages on the video screen and I definitely want my print (.PRN) files stored on the disk. Neither of these is possible as SASSY stands now. In spite of the advantages of multiple file assembly linkage and a cross referenced label table, these two problems preclude my using SASSY as my day-to-day assembler. □

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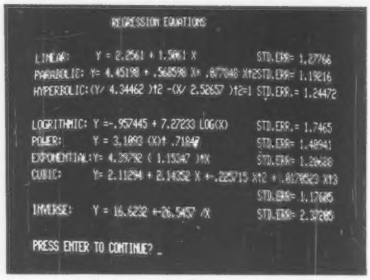
Statistics With The TRS-80

Randy Heuer

Although the sales of microcomputers indicate that the general public is becoming convinced that a small computer can be of some benefit or use, much of the commercially produced software has been concerned with less than serious applications. As a result, many people not familiar with programming end up with a sophisticated and rather expensive video game.


REGRESSION EQUATIONS
LINEAR: Y = 2.2561 + 1.5961 X STD.ERR= 1.27766
PARABOLIC: Y= 4.45198 + .568598 X+ .877048 X↑2STD.ERR= 1.19216
HYPERBOLIC:(Y/ 4.34462)↑2 -(X/ 2.52657)↑2=1 STD.ERR.= 1.24472
LOGRITHMIC: Y =-.957445 + 7.27233 LOG(X) STD.ERR.= 1.7465
POWER: Y = 3.1893 (X)↑ .7184 STD.ERR= 1.48941
EXPONENTIAL:Y= 4.26792 (1.15547)↑X STD.ERR= 1.28688
CUBIC: Y= 2.11294 + 2.14252 X +-.225715 X↑2 +.0178562 X↑3
STD.ERR= 1.17695
INVERSE: Y = 16.6232 +-26.5457 /X STD.ERR= 2.37285
PRESS ENTER TO CONTINUE? _

Fortunately, things are beginning to change. With games now saturating the market, software manufacturers are turning to more serious applications. Some of these applications will, of course, take advantage of the computer's ability to perform numerical calculations quickly and accurately.

One of these applications is complex statistical calculations. In the past, people who needed the results of these calculations were forced to spend countless hours on a handheld calculator or many dollars to use a large computer. For these users, a microcomputer, with an appropriate software package, can be an excellent solution to the problem.

Such a package has been introduced by Creative Computing Software — Advanced Statistics for the 16K, Level II TRS-80 (CS-3303). The package comes with a cassette tape containing nine programs and a comprehensive 5" x 8" documentation booklet packaged in a vinyl binder. The retail price is $24.95.

This package features eight advanced statistical procedures which, in the past, were only available on large computer systems with complex statistical packages. Now anyone can have access to such procedures anytime for less than $900.

The Programs

The heart of the package is the Data File Management routine. This program allows the user to create and modify cassette-based data files. By employing a special feature which loads only fifty data records into memory at any one time, data files can contain an unlimited number of values. This feature allows one to analyze large amounts of data on a relatively small computer. The data files constructed by this program can be used interchangeably with seven of the statistical programs. Thus a variety of tests can be conducted on the same data.

The first statistical program calculates six descriptive statistics of a single variable. These statistics include the mean, median, standard deviation, range, skewness and kurtosis. The program also displays the number of occurrences, percentile and Z-score for each value.

The Two Variable Statistics program is used to calculate the statistical relationships between two variables. In addition to the basic descriptive statistics for each variable, a t-test for the difference in the means, the linear correlation coefficient and its significance level along with a linear regression is performed.

The Crosstabulation program is used to determine whether two methods of classification of multi-

STANDARD CORRELATION COEFFICIENTS
VARIABLES COVARIANCE CORRELATION SIGNIFICANCE: P(
1 2 .661373 .813248 .82
1 3 .58891 .767485 .85
1 4 .19753 .444444 N.S.
2 3 .784867 .829867 .81
2 4 .288896 .536746 N.S.
3 4 .632969 .79873 .82
6 DEGREES OF FREEDOM
PRESS ENTER TO CONTINUE? _

nomial data are independent. For example, one might have the following data concerning the size of car involved in an accident and whether or not there were any fatalities:

TYPE OF CAR

Type of Accident	Small	Medium	Large	Total
Fatal	67	26	16	109
Non-fatal	128	63	46	237
Totals	195	89	62	346

The Crosstabulation program allows one to determine if there is any statistically significant relationship between the size of car and the severity of the injury sustained. The chi-square test conducted by the program will determine if there is any evidence to conclude that the size of the car has any relationship to the severity of the accident. In this case, such a hypothesis is not supported by the data.

While this example uses a rather simple 2 x 3 table, the program can handle tables as large as 10 x 10. In addition to the chi-square value, the program also calculates the level of significance and gamma statistics.

The Regression-Trend Analysis program computes the least squares regression coefficients from paired data. The end result of this procedure is a set of predictive equations. The following models are calculated:

Statistics, con't...

linear, parabolic, hyperbolic, logarithmic, power, exponential and cubic. For each model, the program calculates the standard error of estimate. The user may then select any of the models and enter values of the independent variable. The program will provide estimates for the dependent variable.

Multiple Linear Regression is also used for developing predictive equations. In multiple regression, several independent variables are used to forecast the dependent variable. This program allows the user to perform multiple linear regression using up to ten independent variables. It computes both the unstandardized and normalized regression models and also calculates the correlation matrix, multiple correlation coefficient and standard error of estimate.

The Correlation Analysis program computes the product-moment correlation matrices, multiple correlation coefficients and partial correlation coefficients along with their associated significance levels. An unlimited number of cases for two to five variables may be entered.

Analysis of Variance is a statistical procedure for testing whether the means of three or more groups are equal. Both the standard, one-way ANOVA and the two-way method for classifying data may be employed. Up to 100 individual groups may be included in each test. The program calculates and displays the standard analysis of variance table along with the mean and standard deviation for each variable.

The final program is the Advanced Multiple Regression procedure. This test is similar to the Multiple Regression procedure but provides several additional statistics not available on the other procedure. These statistics include the analysis of variance, a t-test for the population correlation coefficient, t-tests for the individual regression coefficients and values for E(Y) and Y(new).

In Conclusion

The performance of statistical tests is an excellent application for microcomputers. We at Creative Computing Software feel that this package is an outstanding group of statistical programs for the TRS-80 and that it will provide the statistical power that most users require. We believe that this package is a harbinger of many useful packages that will make the microcomputer more than just a sophisticated toy. □

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Serial Interface.

The RS-232 standard assures maximum compatibility with a variety of serial devices. For example, with the AIO you can connect your Apple* to a video terminal to get 80 characters per line instead of 40, a modem to use time-sharing services, or a printer for hard copy. The serial interface is software programmable, features three handshaking lines, and includes a rotary switch to select from 7 standard baud rates. On-board firmware provides a powerful driver routine so you won't need to write any software to utilize the interface.

Parallel Interface.

This interface can be used to connect your Apple* to a variety of parallel printers. The programmable I/O ports have enough lines to handle two printers simultaneously with handshaking control. The users manual includes a software listing for controlling parallel printers or, if you prefer, a parallel driver routine is available in firmware as an option. And printing is only one application for this general purpose parallel interface.

Two boards in one.

The AIO is the only board on the market that can interface the Apple to both serial and parallel devices. It can even do both at the same time. That's the kind of innovative design and solid value that's been going into SSM products since the beginning of personal computing. The price, including PROMs and cables, is **$135** in kit form, or **$175** assembled and tested. See the AIO at your local computer store or contact us for more information.

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Steve Edelman, founder of Ithaca Audio, now Ithaca Intersystems, talks with Dave Ahl about his philosophy, starting the company and future plans.

Ithaca Intersystems, Inc.

David H. Ahl

Dave: Steve, I'd like to give our readers a little flavor of what it's like to start a company and keep it going. What's the background of Ithaca Audio? How did you first get going?

Steve: Frankly, it was a complete accident. Through college, I was in electro-acoustics, i.e., the cross between electronics and acoustics. It's a complicated field and I found it very interesting. January of my senior year, Steve Finney, a friend of mine said, "Let's build a computer." I said, "No, it's too complicated." But it aroused my interest and three months later, I was building one. I graduated from Cornell in June of 1976 and took a job with NCR in Ithaca where, oddly enough, they were building microcomputers. However, their idea of a microcomputer was to take a $5.00 microcomputer chip, surround it with $100,000 worth of metal work and sell it like an IBM 370. This began to drive me crazy because they just didn't seem to understand that they could build complete microcomputer systems very cheaply. Besides that, they put me in charge of unscrewing up screwed up projects. As soon as I unscrewed up one they gave me another screwed up one and never gave me one of my own. After eight

Ithaca Intersystems new home is about a mile from the Cornell campus and boasts 9 acres for expansion. (Eat your heart out Silicon Valley people).

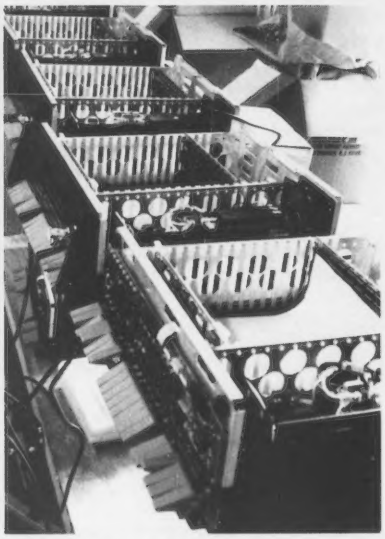
months, I finally told my boss, "Give me my own project or I shall quit." He said, "Oh, you have another job offer." I said, "No. You don't understand. I want my own project or I'm going to quit." We went back and forth but finally he said, "No. We just can't do that." So I left on Friday and had nothing to do Monday morning. That was February of 1977.

Through the fall of 1976, I'd still been dabbling with my own stuff. I finally built my own computer. However, as soon as I got it to say "hello," I got very bored with it because it wasn't S100. Also, I was custom wrapping everything and going nuts making 8K static RAM boards when people were beginning to come out with these things, so I dumped the whole system and started building a new one with the S100 bus.

January of my senior year, Steve Finney, a friend of mine said, "Let's build a computer." I said, "No, it's too complicated." But it aroused my interest and three months later, I was building one.

Also, that fall (1976), I latched on to somebody who was making an 8K board and bought the rights to it. I started selling it by mail order to make enough money to pay for my own system.

Back to February 1977; I ran into Kells Elmquist who was building a computerized animation stand using an Altair 8800. He eventually wrote the S100 spec, and I decided that this new chip, the Z80 looked interesting. Only Cromemco was building a Z80 board and we thought we could build a better one. We set about designing it with the money that I saved up from the 8K board sales, and that became our first project. We started in a building owned by Cornell which cost $20 a month and was smaller than the booth we had at NCC; it's now being condemned. We sat in this tiny room, back to back, doing everything. I took orders and designed simple boards and packed stuff. Kells did the same thing, at the same time trying to design this Z80 board. From there things just kind of went onward and upward. We designed the Z80 board



EPS-1 systems are burned in 24 hours before shipment.

and put the money back in again to pay for the next design, and the third and fourth. Eventually we had half of this now condemned building on four different stories with people running up and down — it was complete insanity.

We started in a building owned by Cornell which cost $20 a month and was smaller than the booth we had at NCC; it's now being condemned. We sat in this tiny room, back to back, doing everything.

Dave: When you first started with the memory board, what kind of capitalization or financing did you have to produce it?

Steve: Zero. At the time the 8K board was started, the paid in capital of the company was about $50.

We're about to make a new name for ourselves.

Not that the old one was so bad. As Ithaca Audio, we've made quite a name for ourselves. As the source for CPU, memory, video display and disk controller boards to upgrade other makers' mainframes and peripherals. The company that makes those neat little RAM expansion kits. And the folks behind the world's only Z-80 Pascal compiler.

But as much as we've enjoyed improving other people's equipment, we've been quietly moving towards larger endeavors, with a lot of encouragement from our customers. Listening to people's problems, as well as their needs. And, as a prime mover behind the IEEE S-100 Bus Standard, answering some really knotty questions.

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There's a lot more to Intersystems. In hardware. And software. All available through the nationwide dealer network we're now assembling.

You can watch this magazine for updates. Or contact us directly for straight, friendly answers and detailed information from key staff people. Just the way you always have. Because even though we're making a new name for ourselves, we'll never forget who made it possible.

InterSystems

Ithaca Intersystems Inc.
1650 Hanshaw Road/P. O. Box 91
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CIRCLE 156 ON READER SERVICE CARD

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Intersystems, con't...

Dave: How do you get someone to etch boards for $50?

Steve: You don't. We only sold blank boards so that's all we had to buy. I went to a company and said, "I would like to make 250 of these." They said, "Do you have any money?" I said, "Yes," and they believed me, took my order, and gave me 30 days to pay. Remember this was at the peak of the hobbyist market and people were spending money like crazy. Within 30 days it was very easy to sell

At the time the 8K board was started, the paid in capital of the company was about $50.

all the boards, pay the manufacturer and have enough money left over to do it again on a bigger scale.

Dave: Did you sell mostly to stores or to individuals?

Steve: In those days there were very few stores. The majority of the hobbyists were still buying by mail order. Even Processor Technology and Cromemco sold most of their systems by mail order in those days. We put little ads in the Micro 8 Newsletter, Byte and On Line and sold all the boards we could make. By then we were putting together entire kits, not just bare boards.

Dave: Effectively then, you bootstrapped yourself up to where you are today. Have you gotten any outside capitalization along the line?

Hank Watson: Initial capitalization was $6000 put up by three people. We held expenses down and were profitable practically from day 1. The first loan we got was to buy this building, along with nine acres of ground for future expansion.

Steve: I think it is really important that a company be profitable from day 1. It's far better than going out and getting a million bucks so you can sit around and design stuff. Concentrating on profits makes you very aware of what's going on. I remember shipping things myself, and I still have a good feeling of what goes on there. I think it's made us very responsive. It wasn't long ago that I answered the phone for everything, and today it's still very easy for customers to get to us.

Dave: At some point along the line, you started positioning yourselves as the OEM market place. What was the purpose of that?

Steve: Complete craziness. We were very engineering oriented and we didn't really believe in fancy advertising. Our ads simply said, "Here's our product and here's what it does." Then somebody suggested that since we were selling blank boards to other companies, on which to put their own parts, we should call ourselves the OEM Marketplace. I wouldn't put a lot of stock in it as far as the image of the company since today only about 40% of our business is OEM.

Hank: Counting the new overseas business, the OEM portion could go as high as 50%. We got a very good reception at NCC. We are up to a stage where much larger OEMs are looking actively at our products.

Steve: But we are still fighting an uphill battle because of our work in IEEE and with the S100. Other S100 manufacturers have failed; also many people still view S100 as simply a hobbyist bus.

Dave: What do you see as the future of S100 given the demise of MITS, IMSAI, Xitan and Processor?

Steve: I would have to say that the demise of those corporations has probably done more to benefit S100 than anything else. For example, in the minicomputer field, you have DEC's uniBus or multibus. In both

Ithaca Intersystems building was formerly the "Doggy Disco" (ASPCA is just down the road), hence the wall decor.

cases, you have a large corporation who has prime vendor status. They are the ones who run the bus. Many times those busses have no standards issued. But you cannot find a standard for unibus, nor for multibus. You can find internal memos, but you will never find a consistent published standard. What happens then is that you've got big daddy waving the stick and all the little boys running around, the elves who try to make plug ins. What we've done by losing MITS, is lost anyone who could claim to be a prime vendor. Cromemco, North Star and Vector are major corporations in the market place, but all of us are on somewhat of an equal footing. We have to cooperate and we cannot become snotty. MITS thought they could just tell everybody we will

Gary Samuels, marketing manager.

change the bus anytime we want and you guys have to follow suit. But today, Cromemco or Vector certainly couldn't do that. For the first time in history, we have a standard bus. It may not be the best, but it means the little guy can't get stepped on by somebody else. It makes a much more competitive market place. I think that because we don't have major corporations who can throw their weight around, it will be a very consumer oriented market place.

Dave: Speaking of your image, where did the name Ithaca Audio come from?

Steve: When I entered college in 1971, hi-fi equipment was mostly sold at fair trade prices, except in a few places with no fair trade laws. I started buying audio equipment from some funny new distributors in Washington, DC, marking it up a little, and selling it to my fellow

What we've done by losing MITS, is lost anyone who could claim to be a prime vendor. Cromemco, North Star and Vector are major corporations in the market place, but all of us are on somewhat of an equal footing. We have to cooperate and we cannot become snotty.

students. That's how I paid for most of my college education—that was Ithaca Audio. When I left NCR with ideas for a company, there was the name. I paid my $5 to the state to get registered, so who wants to pay another $5?

Dave: I think that those kind of distinctive names are really an asset. People remember them, whereas alphabet soup letters or meaningless acronyms have little identity.

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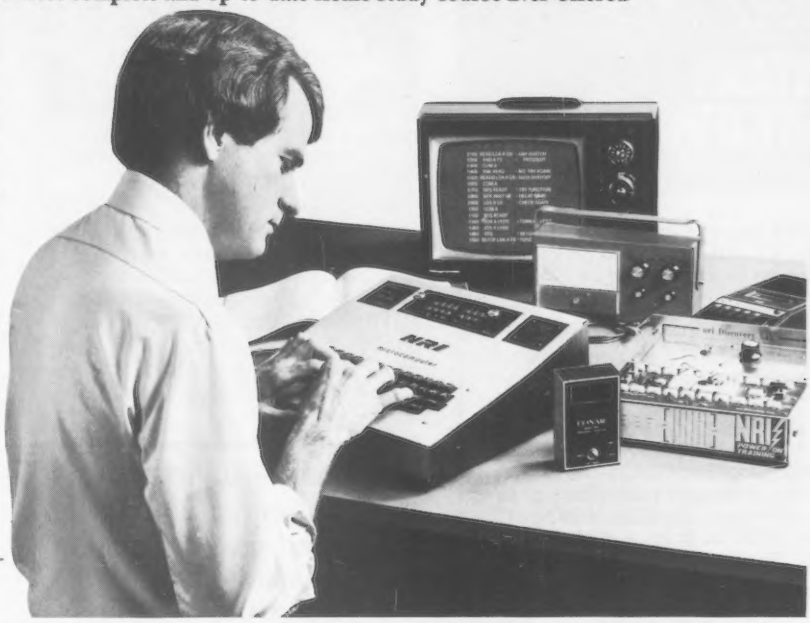

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Intersystems, con't...

President Hank Watson sees substantial growth in the coming year despite the faltering economy.

Steve: There is a reason for the new name, Intersystems. I feel that in the scientific and industrial applications in which we're involved, users will be taking the small machines to do the processing and then communicating with big computers. Intersystems reflects these communications.

A wonderful thing about a small computer is that the data rates between you and your machine are very high, unlike timesharing.

Dave: What direction are your new products taking?

Steve: In general, our products are slanted toward scientific operations. You can expect to see a lot of high technology input/output. Most important, they are slanted toward preserving people's investments which is a real cliche, but I think with a little thought we can do it. We are looking at a lot of A to D and D to A converter boards, very high speed and precision, which is necessary for laboratories. We are looking toward a lot of graphics. A wonderful thing about a small computer is that the data rates between you and your machine are very high, unlike timesharing. This for the first time allows raster scan graphics with millions of dots on a screen so that you can't see individual dots. With vector scan graphics, we can draw thousands of lines. In other words, very high performance graphics at low cost so people can rotate in real time, draw pictures and work in color, all of which are very good for laboratory, scientific and educational applications.

We are also looking at some sophisticated, new kinds of architectures which will allow us to take advantage of the low cost of the CPU and put more than one in a box and divvy up problems. An example of that is the fourier transform where we simply off load part of the problem. Then more sophisticated versions where problems are parsed by the machine and it allocates its own resources automatically. We presented a paper at NCC which described the hardware necessary to put 8 or 16 processors operating concurrently in a S100 bus machine. We are working on the type of operations that have been done at Carnegie-Mellon under CMMP; in other words, make a small machine, which has duplicate parts, run like the sum of the parts. We are trying to divvy a problem into pieces to make it run faster. As soon as you attempt that work you begin to find out that there are two kinds of problems: those which are inherently well parsed into

Founder Steve Edelman left NCR one Friday and decided to start Ithaca Intersystems the following Monday.

pieces and those that are not. For well parsed problems, it is simple to write software. For those that are not well parsed, it is very complex. We are working on both types.

Dave: I assume, then, that you plan to bring out software as well as hardware.

I believe the future of small computers will lie with those people who can bring out good, sensible software.

Steve: Yes, we do. The majority of the work in multiple processor configurations has been done in languages such as Modular Simulant Concurrent Pascal. Our own work with the Pascal compiler certainly indicates that we are briefed in those areas. Second, bringing out hardware

Intersystems, con't...

which could support this kind of software and not bring out the software itself would be a little bit silly. I believe the future of small computers will lie with those people who can bring out good, sensible software.

I think Pascal is going to spawn a tremendous amount of improved software because you can look at it and you can see if the guy knows what he is doing.

We are very much into modularity and systems analysis. Unfortunately, there are many products which do something, but what they do may not make sense, or they have been put together in a way that is not easy to expand or modify. Software, particularly business software, is really guilty of this.

Edelman feels that the loss of MITS, IMSAI and Processor will, in the long run, benefit the S100 bus.

As far as our own new software goes, I am really tickled pink with Pascal. The bench marks on it have been very good. We are running much faster that I could have hoped. It's our own implementation completely. We did it from scratch. We started with nothing but the Jensen and Dietz report, whereas UCSD started with the Zurich P-code, from what we can tell. We designed the stack ourselves, looking for heavy speed. It was also important to us that it generate reentrant Rom-able codes so we could write multi-tasking systems, and so that OEM users could ROM their code. But speed was what we were really looking for, and code efficiency. I'm very tickled with the power that this gives us in the marketplace as a whole. I'm excited about 16 bit machines, but wary of them, too. I don't think people should drop 8 bits for 16. However, when they need 16 bits, Pascal gives people the ability to start writing a code for those machines now. It's the kind of high-level language which is very well suited towards operating systems and applications software of any kind. It forces people to think problems through thoroughly and write good structured code. It can be written on an 8 bit machine and then run on a 16 bit machine. Pascal Z excites me because it means that you can be nearly as efficient as what is possible in assembly language. It means you can go ahead and write on your machine or write on the UCSD P interpreter and then change over to dedicated software for multi-tasking with our compiler or you can move it around to a 6502 or anything you want under their interpreter. So you can go in all directions. If you happen to have our Z80, you can get rip-roaring speed, say 5, 10, or 20 times as fast. You can get ROM-ability and reentrant code. I think Pascal is going to spawn a tremendous amount of improved software because you can look at it and you can see if the guy knows what he is doing. It's as important a development as was the 8080 and the S100 to small computers. That's neat. □

Edelman: "Pascal is as important as the 8080 and S100 bus to small computers."

Hank Watson graduated from Cornell with an MBA and joined Ithaca Intersystems in June 1978 as president to concentrate on the fiscal and business end of things. Gary Samuels joined as marketing manager in April 1979. These key additions permitted Steve to concentrate on managing, engineering and product development. The company employed 27 people as of July 1979.

Annual sales are $1.5 million but the new EPS-1 computer is expected to substantially expand that figure in 1980.

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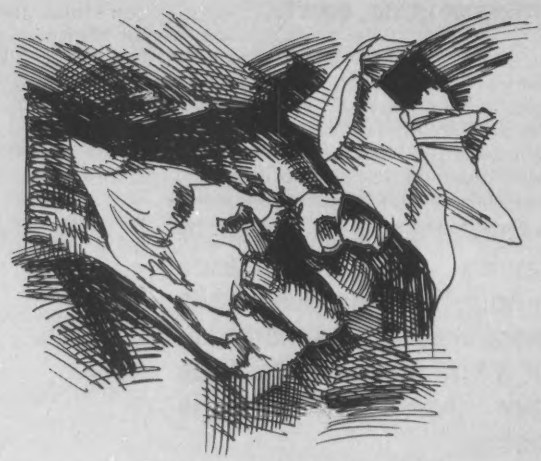
Computerized Biofeedback and Stress Management



Tim Scully, Ph.D.

Editors Note:
In a future issue Dr. Scully will present a construction article on building and programming a simple biofeedback system for a personal computer system.

Stress is killing many of us every year. Ulcers, insomnia, headaches and many allergies are generally accepted as stress-related diseases. Radicals in the medical community say that even cancer is stress-related. Be that as it may, biofeedback stress management training is becoming popular as a medical treatment for stress-related problems. Educational biofeedback stress management training is even more interesting; this training teaches people how to manage stress before it becomes a medical problem. Your microcomputer could become an educational biofeedback instrument.

What Is Biofeedback?

Biofeedback is the measurement of a BIOlogical process and the FEEDing BACK of the results of this measurement to the originals being measured. Looking in a mirror is a biofeedback process in which information about one's facial expression is fed back. Biofeedback training takes place when biofeedback information is used to produce conscious control over the process which is measured and fed back, e.g., when an actor uses a mirror to learn to produce a desired facial expression.

Biofeedback training is usually done to teach awareness and control over body processes of which most of us are not usually aware. These might include the electrical activity of the brain (EEG or electroencephalographic signals), the electrical activity associated with subtle changes in muscle tension (EMG or electromyographic signals), the electrical resistance of the skin (GSR or galvanic skin response and BSR or basal skin resistance) and changes in the temperature of the fingertips. These body processes are usually selected for training because they are fairly easy to measure and because they reflect stress or relaxation. To a lesser extent, they reflect changes in consciousness.

The relationships between body processes and mood or thought are not the same for everyone. You might say that each of us has a personal "body language." But there are some general relationships which you'll need to understand in order to understand biofeedback stress management training.

Skin Temperature

Cold hands and feet are a common stress response, a result of peripheral vasoconstriction. The "fight or flight response" to stress causes the sympathetic nervous system to contract the smooth muscles lining peripheral blood vessels, reducing blood circulation and thus reducing skin temperature at the extremities. A deeply relaxed person may have a fingertip temperature of 37 C (98 F), while a person under severe stress may have a fingertip temperature several degrees colder than room temperature, perhaps as low as 20 C (68 F). This relationship between stress and fingertip temperature has made biofeedback training in handwarming a popular modality for clinical stress management training.

Peripheral skin temperature is influenced by a number of variables, of which stress is only one. The environmental temperature has an obvious influence and most training is done in a constant temperature room with no drafts. A variety of drugs, including tabacco, influence peripheral vasoconstriction. Vigorous exercise increases peripheral circulation and extended immobility decreases it. Even apart from these factors, warm hands do not necessarily imply a state of relaxation, although cold hands are a fairly reliable indicator of the presence of stress. At best, warm hands are an indication of sympathetic nervous system relaxation.

The Electrical Properties of the Skin

Changes in the electrical properties of the skin are caused primarily by changes in sweat gland activity. Your body has two main types of sweat glands: those which respond mostly to temperature changes, which are part of your body's thermostatic system, and those which respond mostly to stress. These glands are not evenly distributed over the skin, and the stress responders which are of interest in biofeedback training are located primarily on the hands and feet.

The relationships between body processes and mood or thought are not the same for everyone. Each of us has a personal "body language."

There are several ways of measuring the electrical properties of the skin, some of which are passive techniques for sensing naturally occurring electrical potentials on the skin

Tim Scully, Ph.D., P.O. Box 175, Albion, CA 95410.

Biofeedback, con't . . .

(EDP or electrodermal potential), while other methods use a sensing current to measure the electrical resistance (BSR or basal skin resistance) or conductance (BSC or basal skin conductance) of the skin.

The baseline levels of these measurements are influenced by many factors including environmental temperature, skin temperature, drug effects, location on the skin and the subject's level of arousal. Short term fluctuations in these measures, as a response to stimulation, are sometimes called GSR or galvanic skin responses. GSR responses may be triggered by sensory stimuli, such as an unexpected sound, touch or flash of light. They may be triggered by arousing ideational stimuli, such as an obscene word, the memory of an unusually pleasant or unpleasant event or the threat of a painful stimulus. They also may be triggered by physical exertion; even holding your breath for a little while will usually produce a large GSR response.

Biofeedback training in increasing skin resistance (BSR) is used as a deep relaxation technique. Biofeedback training with GSR is used in systematic desensitization, a procedure in which excessive response to specific stimuli can be unlearned. Skin resistance usually increases and the size of GSR responses usually decreases with relaxation. But some people with chronic stress have unusually high BSR and may have unusually large or small GSR responses. The lack of a GSR response to a particular stimulus may indicate that it is not arousing, or that the subject is already under severe stress (and hence not responding), or that the blood sugar level is low (skipping a meal often flattens GSR responses), or that skin temperature is low, etc. Thus GSR responses are often misinterpreted. When carefully interpreted, GSR and BSR feedback have proven to be quite useful.

Muscle Tension

Galvani discovered in the 18th century that electrical impulses could trigger muscle contractions. His discovery stimulated much of the early research in neurophysiology and electricity. By the early 20th century, researchers were studying naturally occurring electrical signals associated with muscle action, and the use of electromyography (EMG) to measure these signals for diagnostic and clinical purposes soon become widespread. These uses of EMG data focused on traumatic damage to nerves and muscles, or other neurological pathology, and did not involve much exploration of the real relationship between muscle tension and events in consciousness until after WWII.

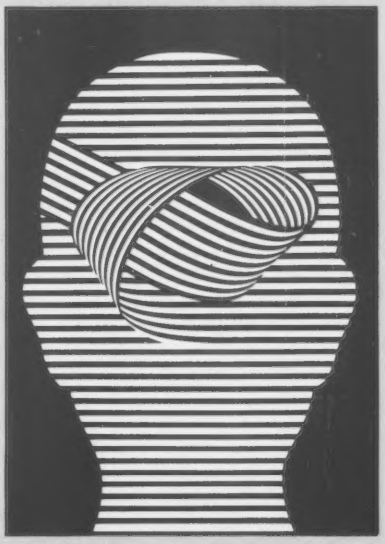
Although skeletal muscles are generally considered to be under conscious control, excess muscle tension is a common companion of stress. Many people with chronic stress are unaware of their habitual muscle tension until it becomes painful (e.g., in a tension headache) and most such sufferers have little or no conscious control over the troublesome tension.

Some psychologists believe that we hide behind barriers of "muscle armor." Others say that there are knots of muscle tension which correspond to "knots" in consciousness, traumas or problem areas. For varying reasons, EMG biofeedback training has come into wide clinical use as a relaxation technique.

The Electrical Activity of the Brain

Hans Berger is generally credited with having first recorded the human electroencephalogram (EEG), the electrical activity of the brain, by attaching electrodes to the exposed cerebral cortex of patients with head injuries in 1929. Later he measured similar but weaker signals on the scalp. Berger hoped to find an explanation for psychic phenomena in EEG measurements, but was only able to find a vague relationship between events in consciousness and EEG signals.

EEG signals are weak, complex, constantly changing and usually are different when measured at different scalp locations. For some purposes, they are classified into four broad categories on the basis of their frequency. Signals between 8 and 13 Hz (Hertz or cycles per second) are called alpha waves because they were the first pattern identified by Berger. EEG signals above 13 Hz, usually weaker in amplitude than alpha, are called beta waves and were the second major pattern named by Berger. Signals between 4 and 8 Hz are called theto waves and those below 4 Hz are called delta.



Some psychologists believe that we hide behind barriers of "muscle armor." Others say that there are knots of muscle tension which correspond to "knots" in consciousness, traumas or problem areas.

Alpha waves, which are usually most prominent in the occipital lobes at the back of the head, are often associated with states of relaxation and with a lack of visual attention (the occipital lobes of the brain process visual information), while beta waves are often associated with arousal, activation and visual attention.

Research on the different stages of sleep revealed that brainwaves progressively slow in frequency as sleep approaches and deepens, from beta to alpha, alpha-theta (drowsiness), a mixture of 14 Hz sleep spindles with a low voltage background (the one departure from a smooth decreasing frequency progression), increasing theta, theta-delta and finally delta during deep dreamless sleep. One of the earliest applications of EEG in the study of consciousness was in the study of sleep and dreaming.

Studies of the brainwaves of Zen monks and yogis revealed that these meditators have an unusual and characteristic EEG pattern consisting of unusually high amplitude alpha spreading over the entire scalp during meditation. Although later research has shown that only some forms of meditation produce this characteristic EEG pattern, these findings stimulated interest in the relationship between EEG and altered states of consciousness.

Early EEG biofeedback training was for the enhancement and suppression of occipital alpha waves, and reports of the high alpha state were similar to those of meditators. This stimulated interest in alpha

Biofeedback, con't. . .

training as an aid to relaxation and meditation. Although some clinical biofeedback training is now done for other purposes, e.g., SMR (sensory motor rhythm) training for control of epileptic seizures, most clinical EEG training is presently alpha enhancement and alpha suppression training.

Pitfalls in Do-It-Yourself Biofeedback Training

Biofeedback training can be an educational experience of great value. It can teach useful physiological self-control skills and increased self-awareness. It can help you to discover how much responsibility you can take for how you feel. But it can also be dangerous if you misuse it.

Medical Problems

Treating your own medical problems with home biofeedback training, without professional guidance, is potentially dangerous. If you decide, for example, that your chronic headaches are due to muscle tension and begin a program of EMG biofeedback training in muscle relaxation, you might delay obtaining professional medical help for a more serious problem, such as a brain tumor. Medical biofeedback training (i.e., training with folks who have medical symptoms) isn't done professionally until a careful medical examination and diagnosis has eliminated the possibility of hidden problems.

If you are taking prescription medication of some kind, especially for diabetes, high blood pressure or some other stress-related problem, there's another potential pitfall. If you do successful biofeedback stress management training, learn to relax and generalize these relaxation skills to your everyday life, then it is possible that the maintenance dosage of your prescription medication could become an overdose! In one case, a diabetic patient collapsed in the street from insulin shock after successful biofeedback training. The solution to this problem is simple. Biofeedback training isn't done by folks taking prescription medication unless the prescribing doctor is willing to become involved. It is necessary to monitor the drug dosage carefully. The patient should be familiar with the early warning signals of drug overdose.

Research on the different stages of sleep revealed that brainwaves progressively slow in frequency as sleep approaches and deepens.

The best advice for those thinking of do-it-yourself medical biofeedback training is **don't.** Such training should be done under professional supervision. Home biofeedback training should be educational biofeedback done by folks who do not have serious medical problems. Many believe that good stress management skills can be valuable as preventative medicine so that problems are less likely to develop later.

Know What you are Training

Another pitfall of do-it-yourself biofeedback training can be training for an undesired response. A poorly designed or improperly operated biofeedback instrument may give you feedback for body processes you don't want to train. For example, most EEF (brainwave) biofeedback instruments will also respond to eye blinks and muscle twitches. A well designed instrument will respond to these with a special signal which indicates that a non-brainwave signal is blocking the accurate measurement of brainwaves. But a less sophisticated instrument or an unsophisticated operator may end up training an eyelid tremor instead of alpha waves!

Electrical Shock Hazard

Most modalities of biofeedback training involve connecting electrodes carefully to your body to get the best possible electrical contact. This is necessary for measuring weak electrophysiological signals. But it can be dangerous too.

Many biofeedback instruments are battery powered. This is a simple way to minimize electrical shock hazard from the power line. Even a battery powered instrument can deliver a nasty shock if it is poorly designed. It is important to look at your circuit design and be sure that the current which can flow through the body is limited to a few microamps, even if part of the instrument fails.

Most computers are power line operated. It is not safe to directly connect your body to a power line operated instrument. Fatal electrical shock could result under some failure conditions. Several people die each year in hospitals from such electrical shocks. The solution to this problem is optical isolation and battery powered physiological data acquisition circuitry. An optical isolator converts an electrical signal into a beam of light whose brightness varies as the electrical signal varies. This light shines onto a phototransistor which converts the optical signal back into an electrical signal. In this manner, physiological data can get to the computer without hazard. Optical isolation also minimizes another troublesome problem: pick-up of power line hum by sensitive EEG or EMG amplifiers.

What to Train and How to Train It

Different people are quite different in their expression of stress. I respond to stress primarily with cold hands while you might respond mainly with tense muscles while your hands remain warm. Because of these individual differences, it helps to pay attention to picking the right physiological modality for your training.

A major goal of educational biofeedback training is increased self-awareness and understanding. This is another reason for beginning your biofeedback training with a period of introspection. In our culture we rarely give ourselves time to sit down, be quiet and learn what's happening inside. Yet this is a crucial first step in biofeedback learning. Listen to your body for awhile, notice how it responds in different situations. You'll find that your awareness of internal events will grow stronger as biofeedback training progresses.

Generally, it is a good idea to begin your training with the modality in which you show the most tension. But, if you have instruments available for other modalities, it is a good idea to check these from time to time, or better yet, program your computer to record data from these modalities while you train with the chosen one. This will allow you to catch any tendency for tension to shift from one modality to another.

How to Relax?

Although you probably could eventually learn good relaxation skills simply by working with feedback signals from your biofeedback system (learning to increase physiological relaxation by a trial and error process), it is helpful to start out with a toolkit of relaxation techniques. Because of variations in people, you may find one exercise most helpful while I might find another to be best. With biofeedback you will have a chance to check out each one and validate its usefulness for you. I suggest that you try each exercise for at least a week of daily practice before you decide if it is effective for you.

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Biofeedback, con't...

Biofeedback and Relaxation

The mind and body are interwoven. The stresses and tensions of your memories and intentions will create corresponding reactions in your body. The stresses and tensions built up in your body will in turn influence your mind.

Still, the mind and the body relaxes. Relax the body and the mind becomes calm.

Unfortunately, you cannot relax by an act of will. Willful desire and active volition create tension.

Relaxation must be permitted. You must learn to allow yourself to untense. You cannot make yourself relax. You can untense yourself by learning to let yourself be. Such

Men are disturbed not by things, but by the views they take of them.

learning is gradual and the skills involved are largely nonverbal. Mastery of the necessary skills depends, not upon rational understanding, but upon regular practice. However, while the skills associated with active effort require energetic exercise, the skills of relaxation require passive exercise. You must practice, but you should not try too hard. You must learn how not to try at all.

One important goal of this training is to learn to be able to relax quickly, anywhere and in any situation. This skill we call the LITTLE RELAXATION. It takes about a second to do it, it's effortless - about as easy as snapping your fingers, and it eventually becomes as automatic as breathing. It is something that you do whenever you decide to do it.

It is important that you set aside some time, on a regular schedule, for deep relaxation every day. A session in which you relax deeply for 10 or 20 minutes is what we'll call the BIG RELAXATION.

Relaxing is a little like riding a bicycle; although you may be able to do it, it is difficult to describe how to do it, using only words. That's one reason why biofeedback instruments, which measure body processes associated with relaxation/tension, are very helpful in learning this skill.

There are different ways of looking at biofeedback instruments. One is to think of the instrument as something for you to control. Another is to think of the instrument as something magical which will do the task for you. These approaches will keep you from getting all the possible benefits of biofeedback training. The best approach is for you to pay very close attention to how you feel inside and to what you are thinking at times when the biofeedback instrument signals relaxation or tensions. The focus of your attention should be inward. It is absolutely essential for you to practice the LITTLE RELAXATION and the BIG RELAXATION in between sessions with the biofeedback instruments. You can use the biofeedback sessions as a way of checking out and validating your relaxation skills.

Here are a few things to think about which will help you gain insight into your own stress and relaxation patterns. What situations are you uptight in? How do you feel when you get uptight? Do your hands get cold? Do any muscles get tense? Which ones? What are you thinking about when you get uptight?

A LITTLE RELAXATION exercise...

Take a deep breath and hold it. Raise your shoulders up high and hold them. Clench your fists and tense up all of the rest of your muscles for a few seconds. Then let go, letting your breath out, letting your shoulders drop, go limp all over and smile, saying to yourself: "What

It is never the event, but rather our interpretation of it, that causes our emotional reaction.

a silly thing to do to my body!" If you are in a public place and can't do the complete exercise, at least use the breath.

Some BIG RELAXATION exercises...

1) Imagine that your mind is a lake or a pond and that thoughts and feelings passing through your mind are like ripples and waves on that lake. The mind cannot be stilled by force. If you could reach out with your hands to smooth away the waves and ripples on the lake, you'd just make

more and more waves. But, if you let go and do nothing, the ripples will slowly die away, leaving a calm lake, smooth like a mirror in which the sensory impressions you receive will be reflected without judgment, attachment or analysis.

An exercise to help you do this is to think the words: "the mind cannot..." as you inhale, and think "be stilled by force..." as you exhale. Pay attention to your breathing and repeat these phrases silently with every breath. Without making any special effort you will find that your breathing becomes slower and your mind calmer. This is an example of the use of a mantra, a simple phrase chanted over and over again to alter consciousness.

2) Another simple mantra which helps many people to relax deeply is "let go." Think the word "let" as you inhale and the word "go" as you exhale. As you exhale, feel stresses and tensions draining out of your body along with your breath. It helps if you breathe from your diaphragm, down low, instead of breathing from your chest...

3) Still another popular mantra is "relax deeper." Imagine a pyramid or a triangle. As you inhale, see the word "relax" running from the bottom of the triangle to the top. As you exhale, see the word "deeper" running down the side of the triangle to the bottom, and feel your body grow heavier, warmer and more relaxed as you slide down from the peak of the triangle.

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4) Guided imagery can be very effective for relaxation. One image some folks work with involves imagining that your body is filled with a warm fluid, the way that a balloon is filled with air. Now imagine that a valve has been opened and the fluid slowly drains out, taking all of your tensions and stresses with it, leaving you limp as a rag doll and very deeply relaxed.

5) Autogenic phrases are another form of guided imagery which can be used in much the same way as a mantra. These phrases invite you to picture various relaxing images and are especially effective in hand-warming or other skin temperature training. Repeat... each... phrase... quietly... to... yourself... very... slowly.

I feel quite quiet.
I am beginning to feel quite relaxed.
My feet feel heavy and relaxed.
My ankles, my knees and my hips feel heavy, relaxed and comfortable.
My solar plexus, and the whole central portion of my body, feel relaxed and quiet.
My hands, my arms and my shoulders feel heavy, relaxed and comfortable.
My neck, my jaws and my forehead feel relaxed. They feel comfortable and smooth.
My whole body feels quiet, heavy, comfortable and relaxed.

....repeat....

I am quite relaxed.

My arms and hands are heavy and warm.
I feel quite quiet.
My body is relaxed and my hands are warm, relaxed and warm.
My hands are warm.
Warmth is flowing into my hands, they are warm, warm...
I can feel the warmth flowing down my arms into my hands.

....repeat....

My whole body feels quiet, comfortable and relaxed.
My mind is quiet.
I withdraw my thoughts from the surroundings and I feel serene and still.
My thoughts are turned inward and I am at ease.
Deep within my mind I can visualize and experience myself as relaxed, comfortable and still.
I am alert, but in an easy, quiet, inward-turned way.
My mind is calm and quiet.
I feel an inward quietness.

....repeat....

The relaxation and reverie are now concluded and the whole body is reactivated with a deep breath, and the following phrases:

I feel life and energy flowing through my legs, hips, solar plexus, chest, arms, hands, neck and head... energy that makes me feel light and alive.

Stretch.

5) Imagine yourself in a very safe and pleasant place, perhaps on the beach, lying on the warm sand, listening to the gentle pounding of the surf, and feeling the warm sun on your body. Let the image become very real, until you can smell the suntan oil and feel the sand between your toes. If you like, imagine yourself running along beside the water, running and running until you are so tired that you can't run any longer. You flop down in the warm sand to lie there limp and warm and relaxed, feeling very good.

6) Another good form of guided imagery for relaxation is visualization of the body process you'd like to experience. If you want a muscle to relax, visualize it as limp and resting. If you want to warm your hands, visualize the veins and arteries relaxing and allowing more warm blood to flow, feel your arms become heavy and limp and imagine the blood draining down into your hands (you may sit so that your arms and hands dangle down). Feel your pulsebeat in the tips of your fingers.

This same creative imagination may be used in other areas of your life. Start thinking and visualizing positively about the things you'd like to do or the things you'd like to have happen. Develop the habit of thinking about, expecting, talking about and visualizing the things you desire, and not the things you fear.

7) Progressive relaxation exercises are a bit more active and are especially good if you are doing EMG training. The idea behind these exercises is to learn how to relax your muscles by learning to sense the differences between relaxation and tension.

The greatest discovery of my generation is that human beings by changing the inner attitudes of their minds can change the outer aspects of their lives. It is too bad that more people will not accept this tremendous discovery and begin living it.

Start out by lying down in a comfortable place. Relax. Pause. Now slowly begin tensing the muscles in your toes. Tighter...tighter...feel the tension and hold it...hold it. Now relax and let it go, completely. Notice how your toes feel when they are limp and relaxed. Pause. Now tense up your toes again. Tighter. Hold it and notice how the tension feels. Okay, relax completely. Let go. Notice how this feels, limp and warm and relaxed.

Now tense all the muscles in your feet, not just the toes. Tighter. Hold the tension and feel it, notice it. Pause. Then let go and relax. Notice how this feels.

Continue this exercise slowly from toes to head. Work with all the muscles in your body. You'll probably find that relaxing the muscles in your facial region makes it very easy to cut down on internal dialogue (self-talk). Eventually, after about 20 minutes, you'll come to the stage where you tighten up every muscle in your body and then let go. Just relax and float along for a while before you return to your normal activities. Enjoy the deep relaxation that comes from completing this exercise.

NOTE: Be gentle in tightening your jaw muscles — don't damage your teeth! □

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CIRCLE 221 ON READER SERVICE CARD

Colorado's Computing Cowboy

Jacquelyn Peake

It was the day before El Paso's big rodeo and champion cowboys from all over the country were hoping they'd be one of the lucky ones who draw a bronc or bull with enough spirit to show off their talents. During the short six hours that entries were being accepted that day, they called in - dozens of them, hundreds of them. Seven hundred to be exact. They were all trying to get their names in the pot. The result was inevitable. El Paso's beleaguered telephone lines jammed and the entire system broke down. No bells tolled in El Paso that day!

This was a common problem with the rodeo business before 1976 when a computer-based organization called PROCOM stepped in and began making life a little easier for the modern rodeo cowboy. PROCOM is a non-profit group of seasoned rodeo cowboys headed up by a soft-spoken young bull rider named Jerome Robinson. With offices in his hometown of Fort Collins, Colorado, Robinson corralled three IBM small business computers into an operation which has brought some welcome organization to the United States' colorful and free-wheeling rodeo business.

They were all trying to get their names in the pot. The result was inevitable. El Paso's beleaguered telephone lines jammed and the entire system broke down.

Ever since the advent of the telephone, rodeo officials have used it to receive entries and to award places on their programs. Traditionally, they would set up temporary phones, as in El Paso, the day before a rodeo and hopeful contestants had to call in their requests for a place. If the cowboy could get through he'd tell the operator which event he wanted to enter, give his qualifications, and hang up. Later on in the day he'd call back, again if he could get through, and find out if his entry had been accepted. It wasn't at all unusual for a cowboy to spend up to eight hours, placing call after call, and sometimes never get through. Then, if he did manage to connect, he'd have to start scrambling for a bus or plane ticket to Dallas or Boise or Albuquerque or wherever the rodeo was being held.

Jacquelyn Peake, 201 South Grant, Fort Collins, CO 80521.

Jerome Robinson rides herd on a bank of IBM Small Business Computers at PROCOM, the organization that's brought the rodeo business into the 20th century.

The system was not only chaotic, it was highly frustrating to the cowboy who just wanted to get on with his business. He never knew until the day before a rodeo whether or not he was entered, so he couldn't plan a schedule in advance to include rodeos on successive days in towns along a reasonably direct route. He'd often find himself dog-legging across the country, crossing his own trail a dozen times a summer in an expensive and sometimes futile attempt to make a living at his trade.

It wasn't at all unusual for a cowboy to spend up to eight hours, placing call after call, and sometimes never get through.

All a rodeo cowboy has to do now, though, to keep up with his profession, is to read the Professional Rodeo Cowboys of America trade paper, the Rodeo Sports News. It tells him where rodeos are being held, what the prize money is, the entry fee, and when entries will be accepted.

Then, for a set fee of $3.50 per rodeo, he can call into PROCOM headquarters, toll free. He tells one of the 22 operators on duty there which rodeo he wants to enter and which event. The operator records the request and tells him when to call back for a confirmation of his entry.

The cowboy's request, along with all others for the same event in that rodeo, is fed into the computer and, if he's eligible (that is, is accredited by the PRCA and has paid his annual dues), he's matched for the event he wanted with a suitable animal.

Once all entries are in, the rodeo committee is given a printout of each event with the names of the performers and the animals they've drawn. The committee then knows exactly how many animals will be needed and can start making plans to have them trucked in.

At the predetermined time, the cowboy will call back and is told which event he's drawn, and if it's a riding event, the name of the animal he'll compete on.

The system is fast and honest. There have been frequent, and often justified, complaints in the past about some officials bending the rules once in a while to let a local favorite compete, even though his entry was late or he wasn't really qualified. The impartial computer, though, plays no favorites, and a performer is awarded an animal strictly on his merits.

Computerizing rodeo entries has also eased much of the strain on a cowboy's wallet. According to Robinson, before PROCOM came along a rodeo cowboy could easily spend

Cowboy, con't . . .

$1000 a year on long distance phone calls alone trying to register for 100 rodeos a season. "He's spending a lot less money now trying to make a living," says Robinson, "and is making more money in the bargain because he can hit more rodeos in less time. The majority of rodeos now close their entries about five days ahead of the show, and the bigger ones, like Frontier Days in Cheyenne, Wyoming, have all their entries in two or three weeks early. Makes it a lot simpler to fill out a schedule."

The impartial computer plays no favorites, though, and a performer is awarded an animal strictly on his merits.

After some initial static from a few of the more independent, and tradition-minded cowboys, PROCOM's computer operations have proved to be a boon to the industry. "Lots of the fellows didn't think this registering by computer would ever work," says Robinson. "And, a few of the older ones still think it's a new-fangled gimmick that will go away some day if they just pretend it's not there. But, I'd say at least 95% of them are sold on PROCOM now."

As for the rodeo officials? "They love it," Robinson grins. "It takes all the

Jerome Robinson keeps track of hundreds of rodeos, small and big, at PROCOM, and makes life a lot easier for the country's professional rodeo cowboys.

obligation of registering entrants off them and has cut their pre-show work in half, at least. And it's saving them money, too. Before, if more cowboys wanted to get in on a rodeo than they had figured on the officials had to rush out and truck in more stock at the last minute. And if not enough contestants actually showed up, they had to send some of the animals back. Those expenses can get pretty heavy. Now they know exactly, at least five days in advance, how many contestants they'll have. Makes rodeoing a whole lot more efficient."

Lots of the fellows didn't think this registering by computer would ever work.

PROCOM will move from Fort Collins to Colorado Springs this winter to join the PRCA office that has recently relocated there from Denver. Robinson, who says he'll never give up riding bulls, says of the move, "We'll have more room there and be able to communicate with one another a lot better when we're in the same area. And, we'll be right near the new Rodeo Hall of Champions that's being built in Colorado Springs."

A few of the older ones still think it's a new-fangled gimmick that will go away some day if they just pretend it's not there.

Rodeo has spawned in the dusty corrals of the old West and nurtured by generations of independent, hard riding, sunburned and saddle-sore cowpokes. It will always be the ultimate symbol of lusty American manhood. That will never change. But, now, thanks to some innovative cowboys from Colorado, and a bank of 20th century computers, the rodeo circuit has finally moved into the age of the integrated circuit. □

"The computer seems to have sprung a leak!"

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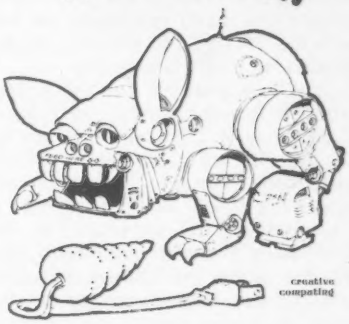

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CIRCLE 218 ON READER SERVICE CARD

Today We Control The House, Tomorrow . . .

Part 2: Interfacing and Software

Mark Garetz

This continuation of last month's article on controlling home appliances and lights with a personal system describes interfacing to S-100, TRS-80, Apple, Sorcer and PET computers. A BASIC control program is also presented along with an improved interface circuit.

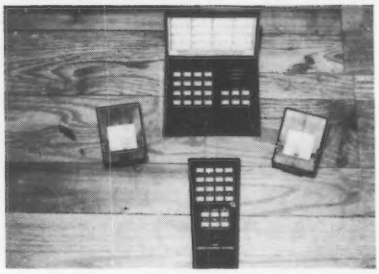
Last month we discussed how to interface your computer to the Sears/BSR home Control System. The interface used some simple circuitry and your computer's latched parallel output port. This month's article will describe an expanded interface for the S-100 Bus, which includes a real time clock, and some software to go with it. We will also show you how to modify the S-100 interfaces for use with the TRS-80 and discuss Apple, Sorcerer and PET interfacing.

We will assume you have last month's article handy, and have already read it. Let's begin by looking at the features of this month's expanded interface. The complete schematic is shown in Figure 1. If you compare the schematic to the S-100 parallel port of last month, you will notice that the address decoding circuitry has been expanded (so we could add more ports) and there's a lot more circuitry.

First, a brief explanation of what the new interface does. We have added a second latched parallel output port and an input port. Then there's a clock chip which is interfaced to the second parallel port. Finally, there are two optoisolators hooked up to the first parallel port which are used to change the house code in the command console.

The features we have added enable the computer to read the time of day and also set it, and the computer can now effectively change the house code switch on the command console giving us direct control of 64 devices instead of 16.

Mark Garetz, Micronics, 1429 Maple St., San Mateo, CA 94402.



The four units which comprise the system.

Circuit Theory of Operation

Now we will attempt to explain how it all works. Let's start with the address decoding circuitry. Address bits A2 through A7 are connected to half the inputs to IC's 1 and 2. Note that last month A1 and A0 were included, but now they have been disconnected. The other set of inputs to IC's 1 and 2 are connected to pull-up resistors and then to a six position DIP switch. The outputs of IC's 1 and 2 are open collector and are connected together with a pull-up resistor. When the address on A7-A2 is equal to the setting of the DIP switch (a closed switch = a high bit match) the output of the nework of IC's 1 and 2 will go high.

There are two optoisolators hooked up to the first parallel port which are used to change the house code in the command console.

Meanwhile A0 and A1 are connected to the select inputs of IC 4, a 74LS139 dual two-line-to-four-line decoder. Only one half of IC 4 is used. The outputs of IC's 1 and 2 are inverted by a section of IC 3 and connected to the enable input of IC 4. This allows A0 and A1 to drive one of the outputs of IC 4 low. The net result is that we have decoded a group of four addresses starting at the DIP switch address. We only use two of the four, but you have the capability to expand the system later.

We only use two of the four, but you have the capability to expand the system later.

Output 0 of IC 4 is inverted by a section of IC 3 and applied to one input of a section of IC 5. The other two inputs to that section of IC 5 are connected to SOUT and the inversion of PWR from the S-100 Bus.

The resulting function is to clock the latches in IC 6 when an output to the selected port number occurs. The inputs to the latches are connected to the Data Out Bus which results in the data being latched into IC 6 at the appropriate time. The data is then stable on the outputs of IC 6. This is one complete parallel output port. IC 7 is wired in an almost identical fashion except that Output 1 from IC 4 is used instead of Output 0.

There are two unused outputs which you may use in a similar fashion for any other project you desire. There is also another identical section in IC 4 that is unused.

The lower 6 data outputs from IC 6 are connected to the 4051's just as in

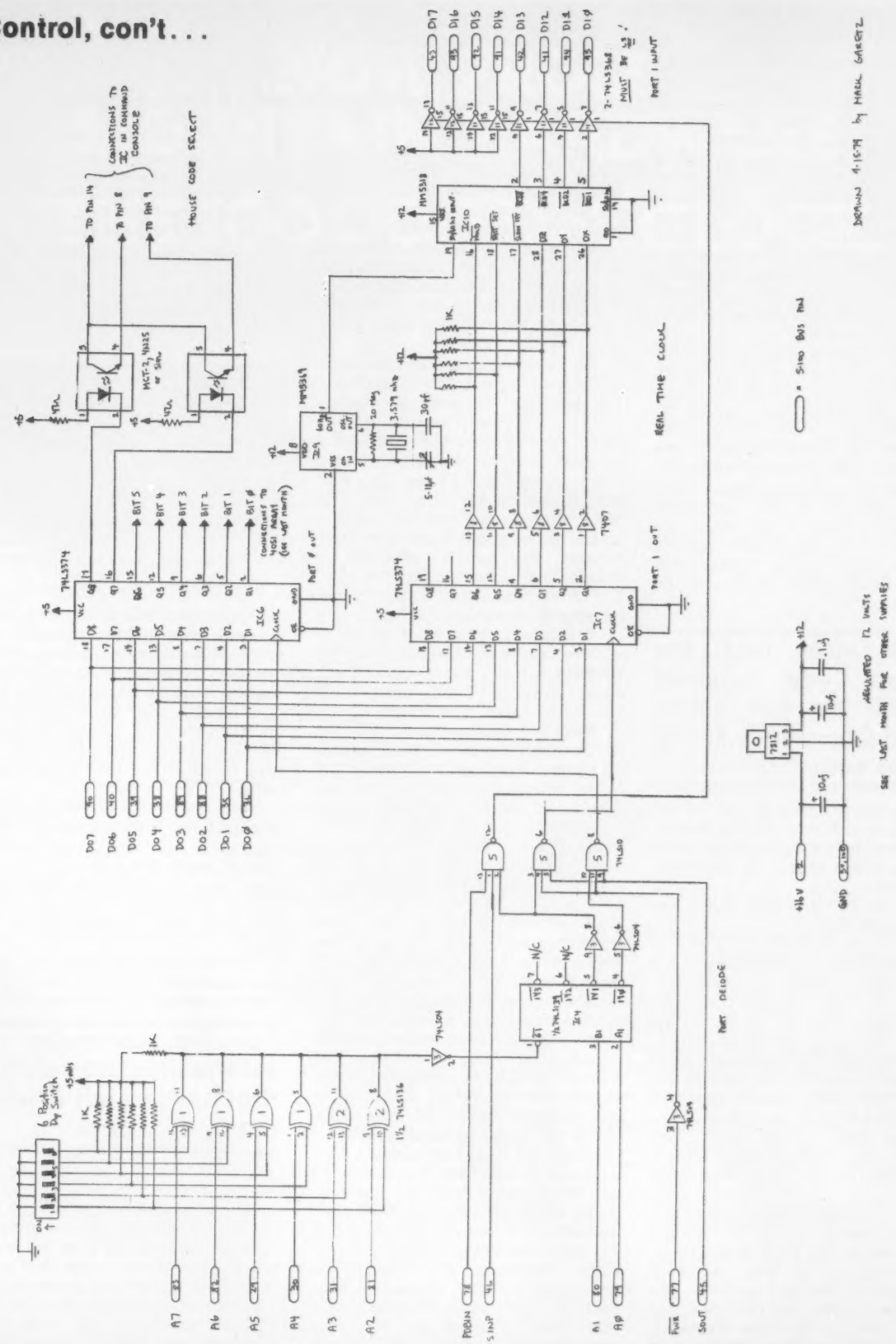

CONNECTIONS TO IC IN COMMAND CONSOLE
MOUSE CODE SELECT
MCT-2, 4N25 or SIM.
PART I INPUT
PART I OUT
PART II OUT
REAL TIME CLOCK
= 5 lead BUS #ad
DESIGNED 4-15-79 by MARK GARCIA
SEE LAST MONTH FOR OTHER SUPPLIES
PART DECODE
6 Position Dip Switch
+5 volts
BIT 5
BIT 4
BIT 3
BIT 2
BIT 1
BIT 0
+5
+12
+10 V
GND

Figure 1

Control, con't . . .

last month's article (not shown on the schematic - see last month). The other two outputs, which were unused last month are connected to the inputs of two optoisolators.

The outputs of these optoisolators are connected to three pins of the microprocessor IC in the Command Console which are labeled in the schematic. Follow the same procedure for doing this as described last month. For purposes of brevity we will not repeat the procedure here. Just make sure you connect the wires to the proper pins.

The purpose of the optoisolators is to select different house codes on the Command Console without having to physically turn the House Code Selector switch. THIS NEXT SECTION IS IMPORTANT! If you implement this portion of the circuitry, make sure that the House Code Selector Switch on the Command Console is set to house code "J." Otherwise the switch will override the computer which means the circuit won't work (and damage might result!).

Make sure that the House Code Selector Switch on the Command Console is set to house code "J."

This setup allows you to switch between 4 different house codes; B,H,J and P. This allows 64 different devices, which should be plenty for everybody.

The bit patterns that select the house codes are:

BIT 7	BIT 6	HOUSE CODE SELECTED
0	0	P
0	1	B
1	0	H
1	1	J

By the way, the optoisolators are necessary because of the hot ground in the Command Console (see last month for a discussion of this).

That only leaves the clock circuitry. The clock consists mainly of an MM5318 "TV" Clock Chip made by National. I chose this chip because it has BCD digit outputs and three digit select inputs. By placing a digit code on the digit select lines, the corresponding digit value is presented to the digit outputs. The computer can thus tell the clock chip which digit of the time display it wants to read and then read it. Now the computer can tell the time!

The clock chip, however, runs on +12 volts so it makes interfacing a bit of a problem, but not too bad.

Interfacing

Let's start from the beginning. The clock chip needs a 60 cycle input which it would get from the AC line in a normal clock environment, which this isn't. I don't approve of running an AC line signal to an S-100 board so I decided an on-board 60 cycle source would be the best alternative. The best way to do this is with a crystal oscillator divided down to 60 Hz.

National makes a chip specifically designed to perform this function - the MM5369. It uses a readily available and cheap crystal - 3.579 Mhz. That's the color burst frequency for those that don't know and there's one in every color TV set. You can probably even get your local TV repair shop to sell you one from a junked set for about 50 cents or less. Anyway, that and an MM5369, a resistor and two caps gets you 60 Hz. The variable capacitor is used to fine tune the clock frequency.

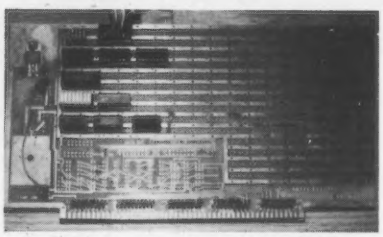
The output of the MM5369 (IC 9) is connected to the 60 Hz input of the MM5318 (IC 10). Since both these chips run on +12 volts there is no interfacing problem here.

Basically there are six inputs to IC 10 that need to be interfaced to the computer. They are the three digit select inputs, the fast and slow set inputs and the hold input. The last three inputs are used to set the time. The problem is that IC 10 expects a high logic level to be up around 12 volts and a normal TTL high output is only around 3.4 volts, which isn't high enough. However, an open collector output can be pulled up that high and that's just the function of IC 8. IC 8 is a 7407, a hex buffer with high voltage open collector outputs.

The inputs to IC 8 come from the outputs of IC 7, our second parallel output port. And, of course, the outputs of IC 8 are connected to the appropriate inputs of IC 10, with pull-up resistors to +12 volts. This solves the input interfacing problem.

There are only four outputs that we need to read with the computer and these are the BCD digit outputs. It just so happens that the BCD digit outputs will directly drive low power TTL when the MM5318 is run on +12 volts. Therefore, the outputs are connected to the inputs of four sections of IC 11, a 74LS368. Note that this IC **must** be LS! The remaining two sections of IC 11 and two sections of IC 12 have their inputs tied to +5 volts. The 74LS368 is an inverting tri-state bus driver, so it also provides the function of inverting the logic of the BCD outputs, which are negative true.

The tri-state control lines for IC's 11 and 12 come from a section of IC 5. One of the inputs to that section of IC 5 is the 1 output of IC 4. The other two inputs are tied to PDBIN and SINP from the S-100 Bus. Thus, the output from IC 5 goes low when the computer reads the port selected by the switch. This is the same port number as the second parallel output so that all clock functions use the same port number.



The ribbon cable wired to the cordless controller.

The upper four bits could have been left unconnected, but then the software would have to mask them (set them to zero) to read the number cleanly. Now the hardware does this automatically. In BASIC, an A = INPUT (PORT NUMBER) statement would return a numeric value for A that is exactly equal to the actual digit value.

Here is how the computer would read the time: First it sends the digit code out to the parallel port, making sure to leave the time setting bits high. Then a read of the input port returns the value of that digit. The process is then repeated for all the digits.

For the computer to set the time, you would first have to tell it what time you desire. It would then set the

For the computer to set the time, you would first have to tell it what time you desire.

fast set bit low and start rapidly reading the hours digits until they are equal to the desired time. Then the process is repeated for the minutes digits by setting the slow set input low. The hours digits then need to be checked for overflow (incrementing the minutes digits past the hour will advance the hours by one). The complete time setting routine (written in BASIC) is presented later.

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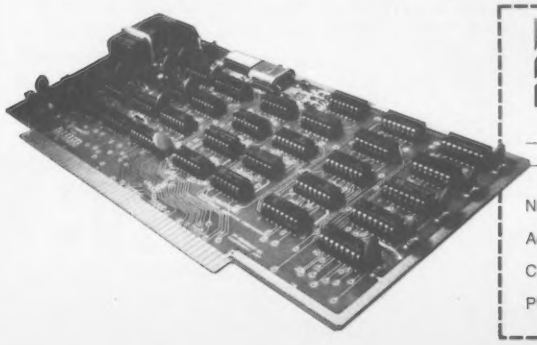

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The clock chip is set to operate in the 24 Hour mode so the program doesn't have to keep track of AM or PM, it's built into the time value (there is no AM/PM indicator on the clock). This is accomplished by leaving pin 13 of IC 10 unconnected (there's an internal pull-up). If you desire the 12 hour mode, simply ground this pin.

This completes the discussion of how the expanded interface circuitry operates. Now on to the software.

The Software

First let me explain what this program's function is. It's basically an intelligent timer that contains a series of commands to be sent to the home controller modules at various times. The commands are stored in the program as "DATA" statements. The commands are: ON, OFF, AOF (which correspond to the house codes) and finally END. Note that the BRIGHT and DIM commands are not supported.

The program is written in North Star BASIC, although I purposely didn't use any of it's "fancy" features so it would be easily translatable into other BASIC dialects (more on this later). It's written semi-modular with most of the repetitive functions being handled by subroutines.

The program assumes that you have the interface we have been talking about and that the ports are at 4 and 5 (the lowest switch position "on" and all the others "off"). This means that the command port is 4 and the clock port is 5. If for some reason you need the ports somewhere else, you will have to modify the IN and OUT statements accordingly.

Let's begin by examining the format of the DATA statements. These statements contain the information that tell the main timing program when to do something and what to do. The data area is from line 500 to line 1999 but you could shift the subroutines down if you need more space.

Referring to line 500, note that all the data values are enclosed in quotes. This is very important because the program treats all these values as strings. The first value is "1730." This is the time at which we wish something to happen. Note that this is 24 hour time (1730 = 5:30 pm). 24 hour time is defined as follows:

0000 is 12 midnight, 0001 is 1 minute after midnight or 12:01 am. 0200 is 2:00 am or 2 in the morning. 1200 is 12 noon or 12:00 pm. The rule here is that any AM time is less than 1200. 1:00 pm is 1300 in 24 hour format and 8:00 pm is 2000. To figure the PM time values in 24 hour format from the 12 hour PM format just add 12 hours (1200) to it. Therefore, 3:30 pm is 330 + 1200 = 1530 and 9:15 pm is 915 + 1200 = 2115. Simple. Just remember that 12 midnight is 0000 not 2400 - 2400 doesn't exist. Also be sure to add leading ZEROES TO AM times. For purposes of this program all time values must be 4 digits. In summary, AM times are left alone but leading zeroes are added and PM times get 1200 added to them. Now back to the program.

Commands may be extended to as many lines as you want.

The time value is followed by the house code letter, B, H, J or P. This tells the program which group of devices the following commands apply to. The house code must immediately follow the time value and must not be ommitted.

Sample Program

```
10 REM  TIMER PROGRAM
20 REM  WRITTEN BY MARK GARETZ
50 OUT 4,255
100 GOSUB 5000\ REM SET TIME
110 GOSUB 4000 \ REM READ TIME (TIME=T)
120 READ C$
125 IF LEN(C$)<4 THEN 120
130 IF VAL(C$)<=T THEN 120
140 GOSUB 4000
145 !T
150 IF VAL(C$)<>T THEN 140
155 GOSUB 3000 \ REM SET HOUSE CODE
160 READ C$
165 !C$
170 IF LEN(C$)<4 THEN 190
180 GOTO 140
190 IF C$="ON" THEN C=49
200 IF C$="ALO" THEN C=50
210 IF C$="OFF" THEN C=53
220 IF C$="AOF" THEN C=54
270 IF C$="1" THEN C=24
280 IF C$="2" THEN C=40
290 IF C$="3" THEN C=25
300 IF C$="4" THEN C=41
310 IF C$="5" THEN C=26
320 IF C$="6" THEN C=42
330 IF C$="7" THEN C=27
340 IF C$="8" THEN C=43
350 IF C$="9" THEN C=28
360 IF C$="10" THEN C=44
370 IF C$="11" THEN C=29
380 IF C$="12" THEN C=45
390 IF C$="13" THEN C=30
400 IF C$="14" THEN C=46
410 IF C$="15" THEN C=31
420 IF G$="16" THEN C=47
430 IF C$="END" THEN 460
440 GOSUB 2000 \ REM SEND COMMAND
450 GOTO 160
460 RESTORE \ GOTO 160
500 DATA "1730","B","1","ON","OFF","ON","OFF"
510 DATA "1731","B","1","ON","OFF","ON","OFF"
520 DATA "1732","B","1","ON","OFF","ON","OFF"
530 DATA "END"
2000 REM SUBROUTINE TO SEND COMMAND
2005 D=500
2010 C=C+H
2020 OUT 4,C
2030 FOR N=1 TO D \ NEXT N
2040 C=63+H
2045 OUT 4,C
2050 FOR N=1 TO D \ NEXT N
2060 RETURN
3000 REM SUBROUTINE TO READ HOUSE CODE
3005 READ H$
3010 IF H$="B" THEN H=64
3020 IF H$="H" THEN H=128
3030 IF H$="J" THEN H=192
3040 IF H$="P" THEN H=0
3050 RETURN
4000 REM SUBROUTINE TO READ TIME
4010 OUT 5,255 \ H2=INP(5)
4020 OUT 5,254 \ H1=INP(5)
4030 OUT 5,253 \ M2=INP(5)
4040 OUT 5,249 \ M1=INP(5)
4050 T=(H2*1000)+(H1*100)+(M2*10)+M1
4060 RETURN
5000 REM SUBROUTINE TO SET TIME
5005 INPUT "TIME? (HOURS,MINUTES)",A,B
5010 H2=INT(A/10)
5020 H1=((A/10)-H2)*10
5030 M2=INT(B/10)
5040 M1=((B/10)-M2)*10
5050 OUT 5,238
5060 H3=INP(5)
5070 IF H3<>H1 THEN 5060
5080 OUT 5,255 \ H4=INP(5)
5090 IF H4<>H2 THEN 5050
5100 OUT 5,241
5110 M3=INP(5)
5120 IF M3<>M1 THEN 5110
5130 OUT 5,253 \ M4=INP(5)
5140 IF M4<>M2 THEN 5100
5150 OUT 5,254 \ H5=INP(5)
5160 IF H5<>H1 THEN 5050
5170 OUT 5,223
5180 GOSUB 4000
5185 OUT 5,223
5190 PRINT "TIME IS SET TO : ",T
5200 INPUT "IS THAT OK? (Y OR N)",I$
5210 IF I$="N" THEN 5000 ELSE RETURN
READY
```

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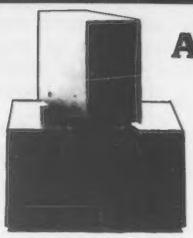

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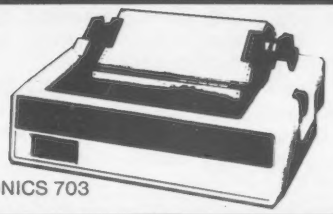

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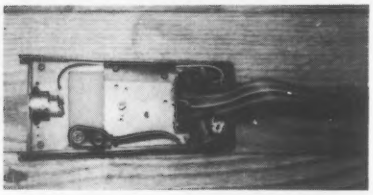
Control, con't . . .

Then come any sequence of valid commands. These are: ON, OFF, ALO, AOF and the numbers 1 through 16. They can come in any sequence and there may be any number of them. They will be sent to the home control system as if you were punching those keys yourself. Commands may be extended to as many lines as you want. The program will continue to send commands in the order that they appear until the program encounters another four digit time value.



To review, the format of the DATA statement is:
500 DATA "TIME VALUE","HOUSE CODE","COMMAND","COMMAND", etc. Don't forget the quotes. One last rule is that the time values should appear from the earliest to the latest if the commands are to be executed properly. Also note that a house code must appear immediately following the time value and only there. House codes are not valid commands.

If you look at line 530 you will see that it contains the data value "END." This should be the last DATA statement and it tells the program to start over at the beginning of the DATA statements. Any DATA statements after "END" will be ignored. Be sure to include "END" or your program will bomb at the end of the first day. (It just now occurs to me that END keeps the program from ending!)

Values should appear from the earliest to the latest if the commands are to be executed properly.

Now that you understand the format of the DATA statements, let's examine the various subroutines. The subroutine at line 5000 sets the time. Line 5005 asks you for the time you want to set the clock to (remember 24 hour mode). Lines 5010 to 5040 break down these two values into 4 - H2 = the highest hours digit, H1 = the lowest hours digit, M2 = the highest minutes digit and M1 = the lowest minutes digit. This is necessary because the computer can only read one digit of the clock at a time.

Line 5050 sets the fast set bit low which starts the clock advancing at the rate of one hour per second. Lines 5060 and 5070 read the lowest hours digit until it equals H1. When a match is found, line 5080 stops the

END keeps the program from ending!

set mode and reads the highest hours digit. If it is not equal to H2 then we go back and begin the whole process over again. When line 5090 falls through (meaning the hours are set correctly) then lines 5100 to 5140 repeat the same process but with the slow set bit and the minutes digits.

Line 5150 reads the lowest hours digit again and 5160 checks to see if it is still correct because if, when setting the minutes, an overflow has occurred (59 to 00 transition), then the hours will be incremented by one. If the value is wrong then we go back to line 5050 and try again.

Line 5170 then sets the hold bit low which stops the clock completely. Since the time setting process may take more than a minute, the time may be slow. Line 5180 calls a routine that reads the time and line 5185 stops the clock again. Lines 5190 and 5200 print the actual time of the clock and asks the user if that is OK. If the answer is yes, the time is set correctly and subroutine returns. If not, we start all over again. Don't worry, it only takes a few seconds to advance the clock by one minute or two.

Next we have the subroutine at line 4000. This is the subroutine that reads the time from the clock. Lines 4010 to 4040 output the proper digit code and then read in the time digit. Line 4050 sets T to a four digit value that represents the time. A call to this routine reads the clock and returns the time in the variable T.

The subroutine at line 3000 reads the house code data and checks to see what it was. Depending on which of the four it was, H is set to a value corresponding to the 2 upper bits that control the house code.

The subroutine at line 2000 actually sends the commands to the home control system. If you remember from last month, we must wait a bit after sending each command to the system. Line 2005 sets D = to the value you desire for the delay. The actual value will depend upon the speed of your system, but 500 should be a good starting point. C is a value that is passed to this routine which contains the bit pattern of the command we wish to send. Line 2010 adds the house code bit pattern to the command pattern so that they may be sent properly. C is set by the main program and H by the house code subroutine. Line 2020 sends the command to port 4 and 2030 inserts a delay. Line 2040 sets C to the NULL command (see last month) plus the house code and line 2045 sends it. Line 2050 inserts another delay after which the subroutine returns.

Now for the main program. First line 50 sends the NULL command to the home control system. Then line 100 calls the time setting routine. Next line 110 calls the time reading routine which returns with T set to the actual time.

Lines 120 through 130 search through all the data statements looking for the first time value greater than the current time. This sets the read pointer to the time value which the computer should act upon next. This value is read into C$.

Line 140 reads the time again and line 145 prints it. The printing of the time is useful only during debugging and the initial use of the program to indicate that something is happening. If you have a CRT you may wish to leave in line 145 but, if you have a printer, yards and yards of paper will be used every minute. Line 150 checks to see if the actual time is equal to the first time value yet. If it's not, we go back to 140 and read the time again. This continues until line 150 falls through.

It only takes a few seconds to advance the clock by one minute or two.

Line 155 calls the house code read routine which sets up H to the value of the house code. Then line 160 reads the first command into C$. Line 165 prints C$ and may be ommitted as above. Lines 170 and 180 check to see if the length of C$ equal to the new time value.

Lines 190 through 420 compare C$ to all the commands and set C equal to the corresponding bit pattern for that command. Line 430 checks for the END value. If C$ is equal to END then we jump to line 460 which restores the read data pointer back to the first DATA statement and then back to 160 to start the whole process over again.

If C$ is not equal to END then line 430 falls through and line 440 calls the send command subroutine. Finally, line 450 sends us back to 160 which reads the next command or time value.

Control, con't . . .

As mentioned before, lines 500 through 1999 are for the DATA statements although more could be added from line 5300 on. That completes the description of the software.

The printing of the time is useful only during debugging and the initial use of the program.

This is written in North Star BASIC but it should translate to other BASIC dialects, such as Microsoft, fairly easily. The backslashes are colons in Microsoft BASIC and the commas used as carriage return inhibitors (e.g., in line 5190) should become semi-colons. The exclamation point is shorthand for PRINT in North Star and should be changed to a question mark or PRINT for Microsoft.

Other Computers

Last month I promised to show you some simple parallel ports for some of the more popular computers. After doing some research I discovered that the TRS-80 is the only one without easy access to a latched parallel port. The PET, SOL and Sorcerer all have built-in latched parallel ports. The Apple has several parallel boards available for it. Two that are suitable are the Model 7720A Parallel Interface from:

California Computer Systems
309 Laurelwood Rd. #18
Santa Clara, CA 95050

and the AIO from:

SSM
2116 Walsh Ave.
Santa Clara, CA 95050

In addition, I have come across an Apple clock board very similar in design to the one presented here for the S-100 Bus. It's the Appletime from:

West Side Electronics
P.O. Box 636
Chatsworth, CA 91311

A fancier and more expensive clock board for the Apple is The Apple Clock from:

Mountain Hardware
300 harvey West Blvd.
Santa Cruz, CA 95060

While we're on the subject of clocks, if you're not interested in wire wrapping the whole expanded interface, several clock boards are commercially available for the S-100 Bus. Mountain Hardware makes one and so do several other companies. The PET has a built-in clock as does a TRS-80 when connected to the expansion interface. Simply substitute your own time set and read routines for mine.

Table 1

Schematic Shows S-100 Bus Pin Name	Pin #	Change to TRS-80 Bus Pin Name	Pin #
A0	79	A0	25
A1	80		27
A2	81	A2	40
A3	31	A3	34
A4	30	A4	31
A5	29	A5	35
A6	82	A6	38
A7	83	A7	36
DO0	36	BD0	30
DO1	35	BD1	22
DO2	88	BD2	32
DO3	89	BD3	26
DO4	38	BD4	18
DO5	39	BD5	28
DO6	40	BD6	24
DO7	90	BD7	20
DI0	95	BD0	30
DI1	94	BD1	22
DI2	41	BD2	32
DI3	42	BD3	26
DI4	91	BD4	18
DI5	92	BD5	28
DI6	93	BD6	24
DI7	43	BD7	20
PWR	77	OUT	12
SINP	46	Connect to +5 volts	
SOUT	45	Connect to +5 volts	
GND	50,100	GND	8,29 and 37

The various voltages required to power the circuitry will be up to you to provide . This is also true of the other computers except the Apple which has the proper voltages available.

Well, there you have it. I hope you have fun. Good luck. □

The contents of this article are presented for personal use only. Permission is granted by the author to individuals to construct the circuits in this article for their own personal use. Any commercial use of the circuitry is strictly forbidden without the author's prior written permission.

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20 Goto mailbox
30 Mail form
40 Recieve the Personal Computer Catalog
50 End Well Done!
Follow this simple program and you will receive The Personal Computer Catalog. The one reference book to fine quality personal computers, software, supplies and accessories.
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A Voyage of Discovery

Peter Payack

Most of Creative's reports, as well as those of other magazines, on conferences and trade shows are pretty much the same - photos of booths, new products and people with accompanying descriptions. However, we were getting a bit tired of this, and we surmised that the same might be true for you readers. So in September we brought you the impressions of CES and NCC from the perspective of a female who was not jaded by years of show-going.

For our report of the small computer show in Boston (a very good show - 20,000 plus attendance), I wanted impressions from somebody outside of the field. Impressions from someone who doesn't "speak the language," like an underground poet (who used to live in the Carlsbad Caverns and communicated with bats), who has now turned "legit." Those of you for whom this is not the first issue of Creative have seen the "Speculative Poetics" feature of Peter Payack; it is he, the 116th incarnation of King Tut's personal valet, TooT, who brings you this astonishing report of the Boston show. — DHA

A Voyage of Discovery

When I entered the Hynes Auditorium to attend the *Northeast Personal & Business Computer Show,* equipped only with vague notions, high expectations, and an exhibitors' map that I was handed at the door, I got the feeling that I had crossed the border into a strange and fascinating adventureland.

After grabbing a hot pretzel from a vendor, I ventured forward into *terra incognito,* leaving familiar Boston behind. I set off like an early explorer, on a daring voyage of discovery, fixing my determination and internal compass on my intended destination: the magical booth of *Creative Computing,* renowned in both legend and lore!

I felt an uneasiness in my stomach, as I passed through the entrance which was guarded by an official ticket-taker on one side, and a burly policeman on the other. I must confess, that no ancient argonauts could have quivered with more apprehension as they passed through the Pillars of Hercules, the end of their known world, than I did at that moment!

I tried with all my strength to keep my objective ruddered straight ahead, only to have the great current of ticket-holders carry me in such a course that I was literally circumnavigating the Show!

One can only imagine my utter astonishment as I passed the numerous aisles of exhibitors populated with many strange, enchanting, and terrifying species of beings, which I had previously thought existed only in Darwin's notebooks or mythological zoos:

Fantastic cyclopian beasts, having but one video terminal in the middle of the forehead!

Coiled serpents of printouts, ever ready to spring to the attack!

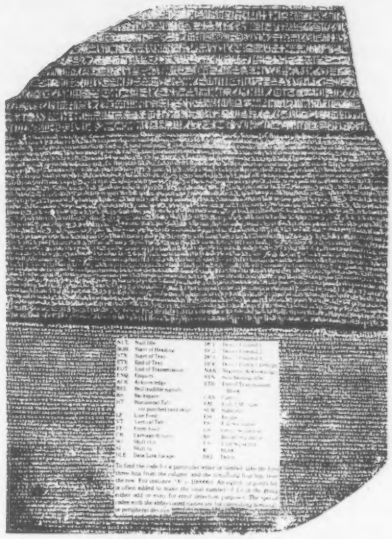
Monsterous thundering dinosaur-like hardware!

Cerberian multiheaded units, strategically located near the entrance to the cafeteria!

Star Wars-like robots roaming about unhindered!

Many times I stopped and tried to converse with the friendly and open-armed exhibitors who inhabited these isles of merchandise. Always I found them most eager to open trade negotiations, only to discover that we were unable to communicate, as they spoke in intriguing and almost untranslatable languages including Basic, Cobol, CP/M, Pascal, or ASCII.

I needed a Rosetta Stone to help me decipher their meanings!



Key to ASCII Code

Rosetta Stone with much sought key to computer languages

One thing I knew for certain, the etymological roots of these peculiar tongues were not of the more familiar Germanic, Latin, Greek, or even Indo-European origins. Possibly, I postulated, they had some strange genesis on some distant star!

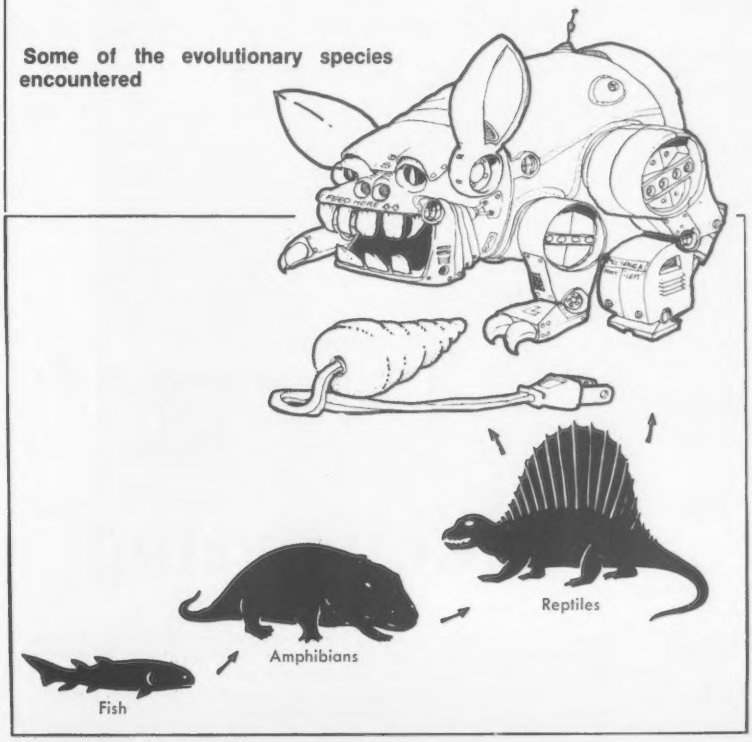
There was a time once, as I continued on my quest, when I passed by an altar to the twin deities of "Business and Home Computing," and had a mystical vision where I thought I saw David Ahl, *in the flesh,* giving a sermon on "Computer Applications"!

Later, I passed off this whole episode as an hallucination resulting from severe malnutrition and *mal de mer!*

Sensing an ever-increasing distance from the entrance, my thoughts grew mutinous, and tried to convince me, nay, force me, to abandon this foolhardy expedition. "There is no such booth as *Creative Computing!"* they cried out in desperation. "The convention center is limited! Surely we will fall off *The Edge* and land in the mouth of some hideous beast if we proceed too far!" they clamored.

Mutinous thoughts

Some of the evolutionary species encountered



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PACKER: Automatically edits all or part of your Basic program to ease editing, run faster, or save memory. Has 5 sections: 1. UNPACK — unpacks multiple state Basic program lines into single statements maintaining program logic. Also inserts spaces and renumbers lines for easier editing. 2. SHORT — shortens your Basic program by editing out all REM statements, unnecessary words and spaces. 3. PACK — executes UNPACK and SHORT, then packs lines into multiple statement lines. Maintains program logic. 4. RENUM — renumbers program lines including all GOTO's, etc. You specify increment. 5. MOVE — moves any line or block of lines to any new location in the program and renumbers lines. Written in machine language, supplied on tape in 3 versions for 16K, 32K, and 48K systems. Works under Level II and Disk Basic. $29.95

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Voyage, con't . . .

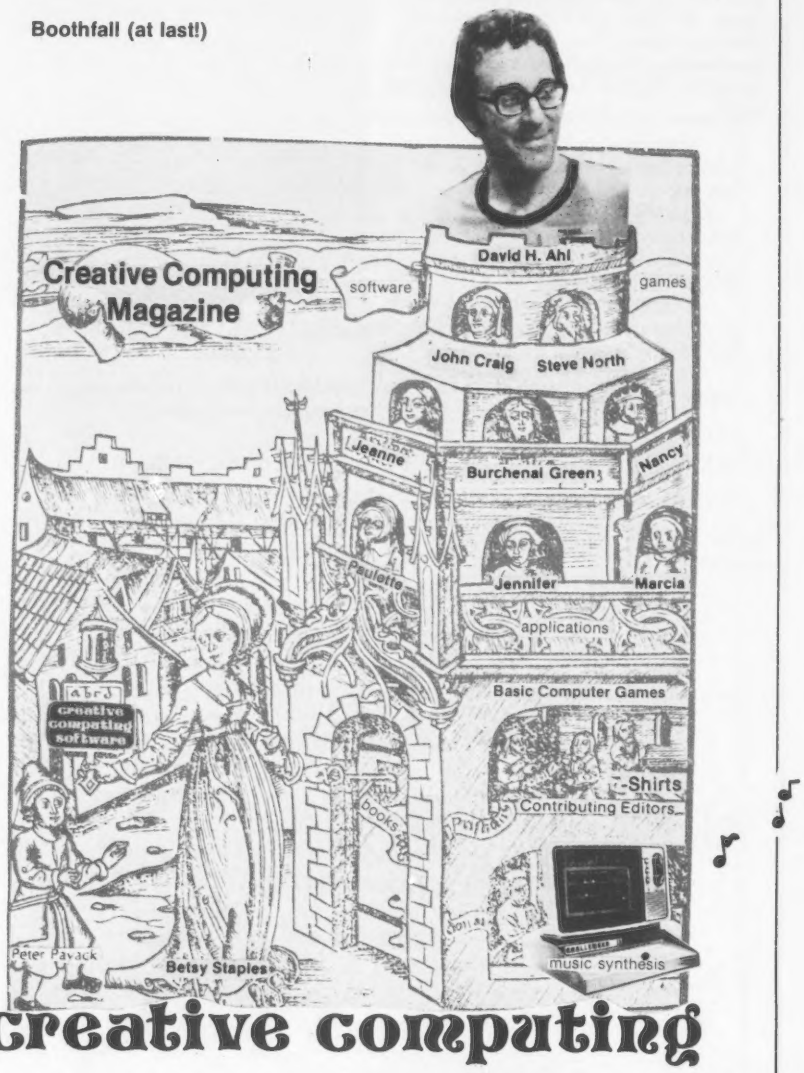
But I had resolved to go forward, and would rather have to eat outdated computer manuals and boiled floppies, than turn back now. "Never!" I shouted like a madman in the middle of a crowded aisle. Many exhibitors backed off a few steps.

Truthfully, I had many doubts myself. I would have already turned back, had not my spirits been occasionally buoyed by my sighting of flotsam that consisted, in part, of leaflets, subscription blanks, and copies of the Sensational Software Catalog, all emblazoned with the *Creative Computing* logo. "Could boothfall be that far away?" I asked myself deliriously.

And then, at the point of my darkest despair, the Siren-Song of computer synthesized music woke me from a deep trance-like slumber. I knew I had reached my destination. "Tierra!" I shouted. "Eureka!" I cried out in ecstasy. "Ya-hoo!" I whooped as I cast anchor amidst the waves of customers.

My journey was at an end.

Boothfall (at last!)



Adventure

A New Type of Game

Welcome to an astonishing new experience! **ADVENTURE** is one of the most challenging and innovative games available for your personal computer. This is not the average computer game in which you shoot at, chase, or get chased by something, master the game within an hour, and then lose interest. In fact, it may take you more than an hour to score at all, and will probably take days or weeks of playing to get a good score. (There is a provision for saving a game in progress).

This game was inspired by the huge Adventure game which has appeared on large mainframe computers the last several years. But there are important differences. Not only will **ADVENTURE** fit into a relatively small computer, but the 'interpreter' is designed so that different Adventures can be created by changing the data base. So look for more Adventures in the future...

In playing the game you wander thru various 'rooms' (locations), manipulating the objects there to try to find 'treasures'. You may have to defeat an exotic wild animal to get one treasure, or figure out how to get another treasure out of a quicksand bog. You communicate thru two-word commands such as 'go west', 'climb tree', 'throw axe', 'look around'.

Six Different Adventures

ADVENTURELAND (by Scott Adams) - You wander through an enchanted world trying to recover the 13 lost treasures. You'll encounter WILD ANIMALS, MAGICAL BEINGS, and many other perils and puzzles. Can you rescue the BLUE OX from the quicksand? Or find your way out of the maze of pits? Happy Adventuring.....

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CS-3506 TRS-80 32K Disk (Includes Pirate Adventure)	$24.95
CS-1009 PET 24K (Includes Pirate Adventure. In Basic)	$24.95
CS-5003 SORCERER 16K (Machine language, available Nov.)	$14.95
CS-9003 8" CP/M 48K Disk (Includes Pirate Adventure In Microsoft Basic	$24.95

PIRATE ADVENTURE (by Scott Adams) - "Yo Ho Ho and a bottle of rum..." You'll meet up with the pirate and his daffy bird along with many strange sights as you attempt to go from your London flat to Treasure Island. Can you recover LONG JOHN SILVER's lost treasures? Happy sailing matey.....

CS-3008 TRS-80 16K Level II (Machine language)	$14.95
CS-3506 TRS-80 32K Disk (Includes Adventureland)	$24.95
CS-1009 PET 24K (Includes Adventureland. In Basic)	$24.95
CS-5004 SORCERER 16K (Machine language, available Nov.)	$14.95
CS-9003 8" CP/M 48K Disk (Includes Adventureland. In Microsoft Basic.	$24.95

ORIGINAL ADVENTURE (by Crowther, Woods, Manning and Roichel) - Somewhere nearby is a collosal cave where others have found fortunes in treasures and gold, but some who have entered have never been seen again. You start at a small brick building which is the wellhouse for a large spring. You must try to find your way into the underground caverns where you'll meet a giant clam, nasty little dwarves, and much more. **This Adventure is Bi-Lingual**—you may play in either **English or French**—a language learning tool beyond comparison. Runs in 32K CP/M system (48K required for SAVE GAME feature). Even includes SAM76 language in which to run the game. The troll says "Good Luck."

CS-9004 8" CP/M 32K Disk	$24.95

MISSION IMPOSSIBLE ADVENTURE (by Scott Adams) - Good Morning, Your mission is to... and so it starts. Will you be able to complete your mission in time? Or is the world's first automated nuclear reactor doomed? This one's well named, its hard, there is no magic but plenty of **suspense**. Good luck.....

CS-3009 TRS-80 16K Level II (Machine language)	$14.95
CS-3507 TRS-80 32K Disk (Includes Voodoo Castle)	$24.95
CS-5005 SORCERER 16K (Machine language, available Nov.)	$14.95

VOODOO CASTLE (by Scott Adams) - Count Cristo has had a fiendish curse put on him by his enemies. There he lies, with you his only hope. Will you be able to rescue him or is he forever doomed? Beware the Voodoo Man.....

CS-3010 TRS-80 16K Level II (Machine language)	$14.95
CS-3507 TRS-80 32K Disk (Includes Mission Impossible)	$24.95
CS-5006 SORCERER 16K (Machine language, available Nov.)	$14.95

THE COUNT (by Scott Adams) - You wake up in a large brass bed in a castle somewhere in Transylvania. Who are you, what are you doing here, and WHY did the postman deliver a bottle of blood? You'll love this Adventure, in fact, you might say it's LOVE AT FIRST BITE.....

CS-3011 TRS-80 16K Level II (Machine language, available Nov.)	$14.95

To order, send payment plus $1.00 shipping or bankcard number to **Creative Computing Software**, P.O. Box 789-M, Morristown, NJ 07960. Or call toll-free **800/631-8112** (In NJ 201/540-0445).

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The East Coast has the Trenton Computerfest and the West Coast has the California Computer Swap Meets.

4th Annual California Computer Swap Meet

John Craig's latest computer swap meet & mini-show was held in San Mateo, California (just a few minutes South of San Francisco) on September 15th, 1979. There were rumors circulating around the Bay Area that Craig was planning to rent each of the selling booths 2 or 3 times...and then take off for Tahiti. When asked about this, a thoughtful look crossed his face as he replied, "Hmmm, I hadn't really thought of that..." Craig was also asked if the rumors were true that he would be putting together a photo story of the event for Creative Computing (i.e., a somewhat self-serving article). "I've been hearing that vicious rumor for weeks now," he responded bitterly, "and I'd certainly like to find the person who started it!"

In spite of Craig's ineptitude at trying to put on a show with only 3 months lead time, the thing was a success. He somehow managed to get notices of the event into half a dozen personal computing publications and 3 or 4 professional newspapers and magazines. The bottom line was the enormous building filled with sellers and the aisles filled with buyers...plus, everyone indicated they had a good time and were looking forward to the next one.

There was a wide variety of software (home & business applications, games, education, even a commercially available pornographic program—which we won't bother mentioning any further), complete systems of all kinds, hardware galore, T-Shirts by the score, books, magazines, printers, disk drives, diskettes and everything else you can think of, it was all there. Perhaps Craig should be given a "Moderately Innovative" Award for arranging for a consignment table at the swap meet. This enabled sellers with only a few items to try to get them sold without renting and staying with a booth all day. Another feature was the Free Literature Table available to anyone in the industry. Both tables will be featured at next year's swap meet.

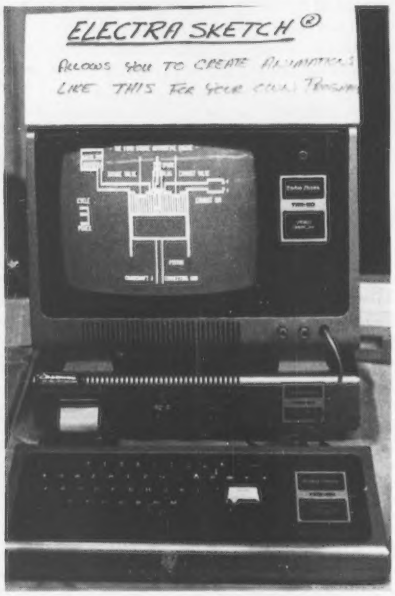
The 5th Annual California (actually West Coast) Computer Swap Meet will also be held in the Bay Area in early or mid-1980. Stay tuned for exact time and location. □

The infamous Gordon French, on the left, has taken a giant step forward with his company, Square 1 (614 18th St., Menlo Park, CA 94025), with the introduction of Floppy Armor for large, 8" diskettes. The new Armor is even better than the popular mini-diskette version because it doesn't require an envelope for mailing. Gordon's associate, Laura Bennett, is normally very sophisticated but likes to stick her tongue out for magazine photos!
(All Creative Computing disk software is Packaged in Floppy Armor.)

Isn't that beautiful? Bruce Chamberlain Company (12071 Tiptoe Lane, Los Altos, CA 94022) designed this eye-pleasing cabinet for the Apple II and two disk drives. Stephen Wozniak, one of the original designers of the Apple, bought one, a good omen.

And that's only one-third of the building!

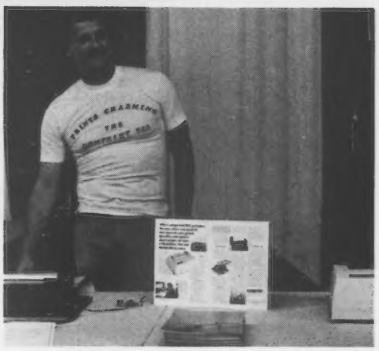
One of the highlights of the show was the auction held by this dynamic crew from Byte Industries, the folks who supply Byte Shop stores across the country (1-to-r: Bob Miller, Jeff Boetticher, Sylvia Norris, Dave Hova.) They cleaned out their back rooms for this event and had some incredible prices on new boards and accessories.



Graphics on the TRS-80! The capability has always been there, and now you can harness and effectively use it with a new animation and graphics compiler from Macrotronics, called Electrà Sketch ($14.95). Ron Lodewyck and Richard Watts had an impressive Electra Sketch program running which depicted the operation of a 4-stroke auto engine. (PO Box 518, Keyes, CA 95328.)

Swap Meet, con't. . .

Five other magazines were at the show but none were having as much fun as the folks at the Creative Computing booth! Creative Computing sells fantastic T-shirts and attractive young ladies stop by constantly to buy them for boyfriends, husbands and fathers. Of course, Creative also has some incredible magazines, books and software!(Advt.)



COMPRINT was there with their fantastic, $560 printer, the 912, being demonstrated by "Prints Charming," Harlan Dybdahl. (340 E. Middlefield Rd., Mt. View, CA 94043.)

The guy on the right is responsible for the board on the left and the one on the left is responsible for the board on the right. This made things very confusing for them (plus everything was upside down) and it took some time to get the new Godbout 12K Heath H8 memory lined up with the new Mullen H8 extender board for the photo. Bob Mullen (Mullen Computer Boards, 2306 American Ave., Hayward, CA 94545) lives for these swap meets and always makes a bundle selling off all the "junk" he's accumulated during the last year, along with his S-100 Opto-Isolator Controller boards and Heath H8 extender boards. Bill Godbout (Godbout Electronics, Box 2355, Oakland Airport, CA 94614) sold out of his new S-100 Memory Manager (a memory management/expansion system), memory and I/O boards, keyboards and everything else he brought. (As a matter of fact, he was perturbed that he didn't bring 2 truckloads to the swap meet, instead of just one.)

Robert Elliot Purser (PO Box 466, El Dorado, CA 95623) has an excellent quarterly publication called Computer Cassettes Review which reviews computer cassettes (for the TRS-80, Apple & PET.)

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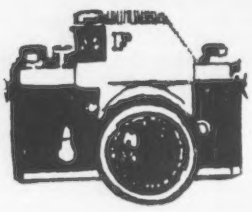

Computer Portraits and Much More

Digitized Video Images

John Craig

If you've been looking for a low-capital business venture for your Apple, North Star Horizon, or other S-100 system, then look no further...you may have found it.

Computer portraits have the same appeal that Polaroid cameras had many years ago when they were first introduced. There was a real fascination then as people watched their images appear on film only seconds after a photo was taken. Today that same fascination can be seen as people watch their images being printed out, line by line, on a line printer.

I recently got caught up in this fascination with computer portraits and decided to put a system for producing them together. My objective was to get a feel for the operation of such a system, the reliability, the costs and the money-making aspects. I'd like to share the experience, and some objective comments, with those interested in putting one together with the idea of making money. (Not too many people will invest in something like this unless they do intend to make money with it.) Even though I wouldn't want to get into the business full time, it is a lot of fun (especially if you enjoy working with people). I hope to provide some ideas and considerations for those who are interested...either as a full or part-time endeavor.

Yes, the picture of the two young ladies on the wall is a portrait taken by the system. The system consists of the following components (from left to right): Malibu 160 printer, North Star Horizon II, Advanced Video Products camera (on top of Horizon), Soroc IQ-120 terminal and video monitor. The digitized image of the young lady on the monitor (which is also being printed on the Malibu) demonstrates the quality obtained from Vector Graphic's Hi-Resolution board.

CREATIVE COMPUTING?

Beyond Portraits

There's more to image processing than just computer portraits. The system I'll be describing can be used for a wide range of image applications and, in most cases, for much less cost (in hardware) than the portrait system requires. We're talking about applications which involve digitizing the image from a TV camera, storing it in memory or on disk and then doing something with it. (In the case of portraits the "doing something" is dumping the picture out to a printer.)

Imagine replacing a facsimile system with an inexpensive, micro-based system such as the one we'll be discussing. I'm sure there are a number of facsimile applications which don't require the "semi-photograph" quality they provide and could get by with the resolution of this system at a much lower cost. Figure 1 is an example of this kind of quality. There are other applications to be considered where images can be transferred via phone lines or slow-scan methods. For example, there's a potential for using this image processing system in a real estate company for storing pictures of homes. These pictures could also be transmitted from one office to another. Real estate agents always go out and take photos of homes they're listing.

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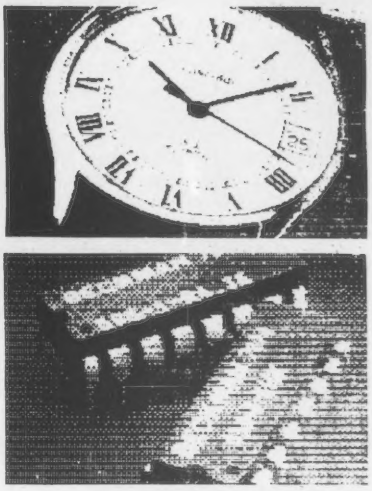


Figure 1. What do you think? Would this quality be adequate for replacing a facsimile or other expensive image processing system?

Using this system they would have to make sure they came back with high-quality photos (preferably, 8x10 enlargements). The TV camera would then be used to take a picture of the photo. This image would be digitized and stored in memory (an 8K chunk of memory). The next step, of course, is to store those images out on disk. At 8K apiece, we're only going to be able to get 11 pictures on a single-density mini-drive (90K), 22 pictures on a double-density drive, or 44 with two drives. With standard-sized 8" drives you go from 31 pictures on a single-density drive up to 124 pictures on two double-density drives. Since most realtors use multiple listing services it seems unlikely that those storage capabilities would be worthy of consideration. I suspect there are other information storage and retrieval applications such as this one which might be even more practical.

Other image processing applications which would use all or part of the system we'll be examining include: precision measurements and general shape recognition on a production line; point in field tracking such as letting the computer "look" into a telescope and track a star, comet, satellite and other celestial bodies; area analysis in a security system and, of course, robotics.

Assembling a Portrait System: The "Bits & Pieces" Approach

It's not really a "bits and pieces" approach but, rather, a modular approach. The modules that make up a portrait system are: the computer, video camera, digitizer board, high-resolution graphics board, TV monitor and a printer. Figure 2 is an interconnection block diagram of the system.

Computer System - There are a couple of personal computer systems which could be used to put together a system using the modules we'll be discussing; either an S-100 system or an Apple. My choice, since it's the system I have, was for the S-100 version. More specifically, a North Star Horizon II is the heart of the system. And, since this particular application is demanding and sometimes even brutal, due to all the setting up and tearing down, I feel the Horizon is a good choice because it can take it. Since my earliest days of "playing" with personal computers I've had more than my share of transporting a system somewhere and then face the frustration of trying to make it work. I've never encountered that problem in the year and a half of operating the Horizon. I've packed it up for short and long trips, including setting up this portrait system, and always experienced the pleasure of having it fire right up. The Horizon is configured with 40K of RAM, dual double-density disk drives, Soroc IQ-120 terminal along with the boards discussed below.

Video Camera - The FS-II TV camera from Advanced Video Products is ideal for this application and is being used in several other commercial portrait systems. The camera comes complete with its own power supply, has a manual zoom lens, "Bright" and "Overcast" aperture switch settings, and a through-the-lens viewfinder.

Digitizer - It's difficult to say that any one component is critical to the system, since they all need to be present and working together. The DS-80 Digisector board from The Micro Works is, however, a key part of the system since it takes the video signal and digitizes it for storage into the computer memory. The DS-80 was picked for the job because of its high resolution and because it's one of the few S-100 digitizer boards on the market. The board resolves an analog video signal into 256 by 256 pixels, or picture elements, and provides up to 64 levels of grey scale. It receives video from the camera which is sent into the digitizing circuitry and, in addition, buffers the video signal and provides it as an output to the video monitor. This provides for viewing the camera output and adjusting the lighting and subject before "snapping" the picture. The image is actually scanned by a vertical white bar which moves across the monitor screen, taking about 6 seconds to travel from the left to the right side. This scanning time is fine for most subjects but makes taking pictures of pets and babies rather difficult (they rarely stand still for 2 seconds, much less 6).

Hi-Resolution Graphics - An important capability in image processing systems is to be able to look at the digitized image after it's placed in memory. The High-Resolution Graphics Display board from Vector Graphic provides that capability along with the necessary high resolution. The switch shown in Figure 2 is mounted on the back of the computer and allows selection of the video signal from the camera for display on the monitor or the digitized image in memory (i.e., the output from the Vector Graphic board). The resolution provided by the board is

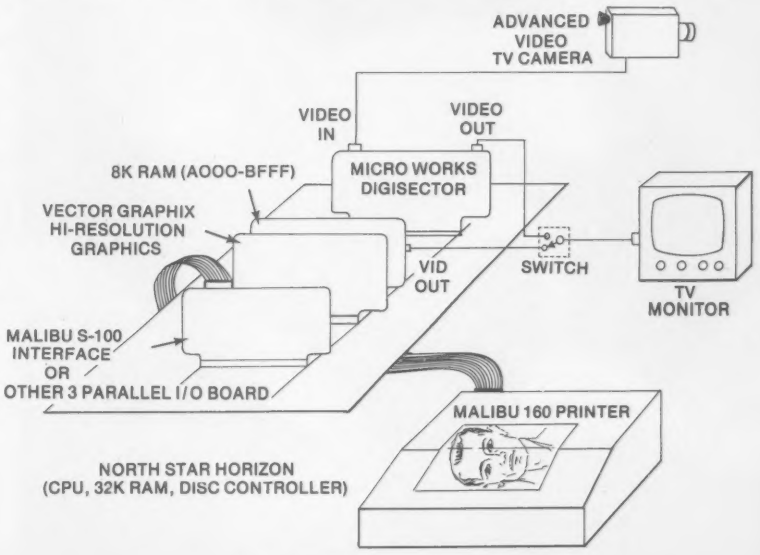


Figure 2. System interconnection diagram.

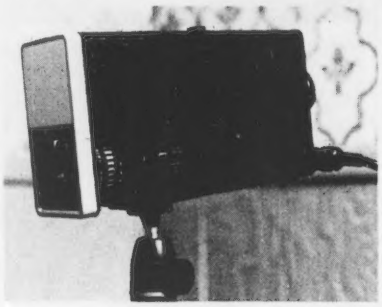
Images, con't . . .

256 x 240 pixels and the quality is excellent, even from a slight distance it's difficult to tell the digitized image from the video. One "disadvantage" of using this board is that it must be used in conjunction with a Vector Graphic 8K Static RAM board for storing the image. As a matter of fact, the two are connected together by several ribbon cables. No doubt this approach helps sell memory boards for Vector Graphic and just as certainly it would be more economical for the customer to be able to use existing RAM.

Printer - Quite frankly, few printers can provide the quality and detail necessary for good portraits as well as the Malibu Model 160. Aside from the fact I had seen the Malibu used in this application before, there were two other reasons why I chose to use it. First of all, I had one. Secondly, The Micro Works provides software for operating with the Malibu. (Or, maybe that's why I chose The Micro Works board?) The portraits appearing in this article are, without a doubt, the greatest testament to the Malibu's quality. The printer requires three parallel ports for interfacing with the computer. I used the Malibu S-100 interface board, which has programs in EPROM for generating normal character and controlling paper and head movement, but it's possible to do the whole thing with any 3-parallel I/O board. As a matter of fact, Malibu has recently developed just such a board. The printing of the lines which make up a portrait are accomplished totally by software. When using the printer for normal operation, with the 3-parallel I/O configuration, all of the character generation and mechanical motion control is accomplished by a program in RAM (the same program which is in EPROM on the S-100 interface board).

The Software

As I mentioned before, the software for the system is provided by The Micro Works. Unfortunately, it's only made available as source listings in the manuals which, of course, is better than a poke in the eye with a sharp stick. There isn't that much code to punch in but it would still be nice if it came on a diskette. However, the folks at The Micro Works are in the hardware business not the hair-pulling, frustrating software support business. There are four routines (menu, scan, print & store) which were developed to run under CP/M. I entered and assembled them running under Lifeboat's CP/M for the North Star. The drawback at this point, if it can be considered that, is that the user must be familiar with assembly-language programming and CP/M directives in order to get the system up. And, the person is going to have to be able to dig into the hardware to some degree, specifically the Digisector, Malibu I/O board and High-Resolution Graphic Board, and set the I/O port assignment and memory addressing dip switches so they match up with the software. I had to make a call to The Micro Works when it came to setting those switches on their board because their otherwise excellent manual wasn't clear on that point although it could have been me. I also had to make a call to Malibu regarding a software question on line spacing. Nevertheless, the development of the software package went smoothly and came up running after some minor debugging.



Advanced Video Products' TV camera, which comes complete with pistol grip (not shown) and power supply. The most important consideration when using the camera is to make sure the lens cover isn't left open with the camera aimed at a stationary object...which will result in the object being burned into the vidicon.

Using the System

It's all in the lighting. If the lighting is right, the portraits are usually right. Two 650 watt floodlights mounted on a tripod provide more than enough light. One is pointed at the ceiling to provide indirect bounce lighting with the other pointed above the subject's head. In the initial stages it's necessary to take a few pictures, look at the digitized image, and then make adjustments to the contrast, brightness and centering controls on the Digisector board until adjusted properly. If the picture is too heavy in contrast, i.e., very black dark areas, the Malibu will be overworked and the print head solenoids will become hot and malfunction, resulting in snagged ribbons. However, with the pictures properly adjusted, the Malibu will sit there cranking them out all day long.

Assuming we have the program loaded and running, the actual operation of the system, which can be taught to anyone within a matter of minutes, involves the following steps:

1. The subject is seated, facing the camera, or looking off at an angle.
2. The floodlights are turned on and the lens protector on the camera is opened.
3. After the proper pose is struck the subject is instructed to remain still and the operator presses "T" on the keyboard for "Take" a picture. The vertical scanning line crosses from left to right across the monitor screen.

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4. The lights are turned off, the lens protector on the camera is closed, and the switch on the computer is thrown to examine the digitized image on the monitor.

5. If the digitized image looks good the operator presses "P" for "Print" and the image begins printing on the Malibu (sideways). The printing takes approximately 2.5 minutes while the subject stands there grinning.

6. At the completion of the printout the operator can save the image onto disk by pressing "S" or simply go ahead with another portrait. (Actually, the next subject can be set up while the picture is being printed out.)

The actual mechanics of operating the system are relatively simple. The real key to being successful with this thing as a business involves knowing how to deal with people and, oftentimes, their egos. A good example of that occurred one evening while I was demonstrating the system at our local computer club. A young man, about 12 or 13 years old, sat down to have his portrait taken. After it was printed out, and several people exclaimed how good it was, I decided that I would save it on disk perhaps to be run off again for this article. He was a strikingly handsome young man and the portrait captured all of his good looks. Some time later he came back and practically insisted that I take another picture of him because he was so unhappy with the first one. I had to turn him down because there was a line of people waiting to get portraits. The incident points out the kind of problems a person might encounter. This is a situation that would have to be properly handled in a money-making environment so that too much time wouldn't be devoted to one customer, particularly if there was a line of people waiting. It's really the same thing a photographer has to contend with except you'll be getting immediate feedback from the customers. (By the way, an interesting optional feature to offer with the portraits is the person's name or a "one-liner" printed at the bottom. Something like "1959 Crest Toothpaste Test Winner" or "Romper Room Reject" or "Undercover Cover Girl" or "Dart Board.")

System Costs

Table 1 and Table 2 list the prices for an S-100 or Apple portrait system. These prices are incredibly low and become even more significant when compared to some of the commercial portrait systems on the market. $20,000 for a minicomputer-based portrait system is not unusual, and the quality of their portraits is comparable or less than our S-100 or Apple systems. What the heck, if you don't want to go into business selling computer portraits, perhaps you ought to look into building and selling portraits **systems.** Could be a lucrative business to get into. Could be a pain in the neck, too.

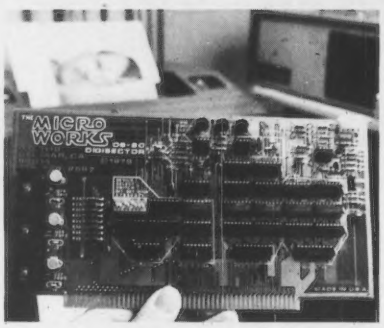
North Star Horizon II Computer with 32K RAM and dual disk drives & controller (assembled)	$2099.00
Advanced Video Products FS-II TV camera & power supply	295.00
Micro Works DS-80 Digisector	349.95
Vector Graphic High-Resolution graphics display	235.00
Vector Graphic 8K Static RAM board	245.00
Malibu Design Group Model 160 Printer (w/stand, cable & 3-parallel I/O board)	2486.00
Soroc 120 Terminal	995.00
TV Monitor	200.00
Floodlights (2)	45.00
Total:	$6949.95

Table 1.
S-100 System Components

The price for the Horizon II in Table 1 can be reduced by purchasing a kit version and, possibly, a single drive Horizon I. However, I wouldn't recommend a single drive system to my worst enemy. There are simply too many occasions when 2 drives are needed (especially when backups are being made). The price of the S-100 system could also be brought down, almost equal to the Apple, by eliminating the Soroc terminal. The Vector Graphic High-Resolution board could be used for normal character generation on the monitor. A keyboard would be the only additional hardware needed ($50 to $100).

Apple II Computer 32K memory and dual mini-disks & controller	$2435.00
Advanced Video Products FS-II TV Camera & Power Supply	295.00
Micro Works Apple Digisector (Price is approximate & unit may still be in development)	300.00
Malibu Design Group Model 160 Printer w/Apple Interface, stand and cable	2621.00
Video Monitor	200.00
Floodlights	45.00
Total:	$5896.00

Table 2.
Apple System Components



The DS-80 Digisector board from The Micro Works which digitizes the video image prior to storage in the computer's memory.

There aren't any apparent cost-reductions in the Apple configuration. In either case, S-100 or Apple, shopping around might lead to lower prices. Lower costs, notwithstanding, you want to keep in mind the software compatibility of the two packages I've described. If you go out and find a less expensive high-resolution graphics board, for example, you'll have to modify the software to go with it. And, speaking of software, Softape is providing support programs for The Micro Works' Apple Digisector. The package is called "Applelooker."

Is It A Money-Maker?

It wasn't for me, but it can be for you. Actually, I never sold a single portrait. I was tempted to buy a booth at a 2-day recreational vehicle and sports convention with a projected attendance of 35,000. The booth would have cost $400. I figured, very conservatively, if I could sell portraits to 1% of the

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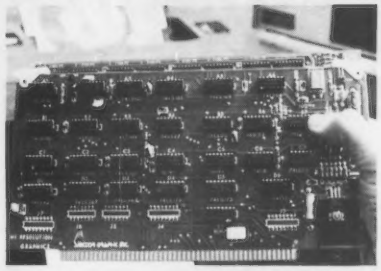

Hi-Resolution Graphics board from Vector Graphic and its companion 8K RAM board (behind graphics board).

attendees, at $3 each, I would make $1050 (350 people times $3). Then, the matter of timing was brought up. If I took one protrait every 3 minutes (30 seconds for setup and 2.5 minutes for printing) that would be 20 pictures per hour. 20 times $3 would be $60 per hour. Assuming an 8-hour day, and a two-day show, we'd come up with 16 times $60, or $960. Of course, all of that is assuming you've got a continuous line of people waiting for portraits which isn't realistic (pleasant to contemplate, but not realistic).

There are several factors which could increase that amount; for example, the hours would likely be 10 or 12 per day. And, charging more than $3 would increase the income, although I don't think they're worth more than that.

Then, there's the matter of overhead. The booth would cost $400. If you didn't run the booth yourself, there would be 16 hours times $2.90 (minimum wage) to pay someone else to do it ($46.40). In addition, you should count your own time for transporting, setting up and tearing down the system, plus the cost of that transportation. Overnight lodging would also come into the picture if the event was out of town. What it boils down to is that you might earn, at a maximum, little over $400 for that 2-day effort, which isn't an amount too many people would sneer at. The whole idea becomes even more attractive when you consider that it can be done on a part-time basis. Since the $400 profit was based on a continuous stream of portrait customers, which is unlikely, you shouldn't rely on just portraits for this venture. Biorhythms, astrology charts and heat-transfer of portraits to T-shirts are additional crowd pleasers and income sources. When it comes to "marketing" the product you should also look beyond fairs and conventions to stores, banks and other establishments having sales, grand openings, or other reasons for wanting to pull the public in.

Keep in mind the other image processing applications for the system. There are a number of commercial and industrial applications waiting for this system. And, if you're fired up about the computer portrait idea, remember that it's just as important to enjoy yourself as make money with the system. If you get a kick out of dealing with those customers, they'll enjoy doing business with you, and next think you know, you'll have a successful operation. □

Advanced Video Products 15460 Union Avenue San Jose, CA 95124 (408) 224-0606	FS-II Video Camera
Apple Computer Company 10260 Bandley Drive Cupertino, CA 95014	Apple II computer system
Malibu Design Group 8900 Eton Avenue, Suite G Canoga Park, CA 91304 (213) 998-7694	Malibu Model 160 Printer & S-100 and Apple interfaces
North Star Computers 2547 Ninth Street Berkeley, CA 94710 (415) 549-0858	Horizon II Computer system & Soroc IQ-120 terminal
Softape 10756 Vanowen St North Hollywood, CA 91601	Support software for The Micro Works Apple Digisector
The Micro Works PO Box 1110 Del Mar, CA 92014 (714) 942-2400	Digisector boards for 8080/Z80 S-100, 6800 S-50 and Apple systems
Vector Graphic, Inc. 31364 Via Colinas Westlake Village, CA 91361 (213) 991-2302	Hi-Resolution Grahpic board & 8K RAM board & S-100 Digitizer

Table 3.
List of Manufacturers

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Shugart 800/801R 8" 495.00

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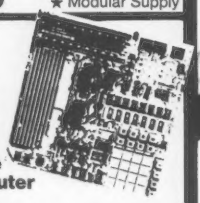

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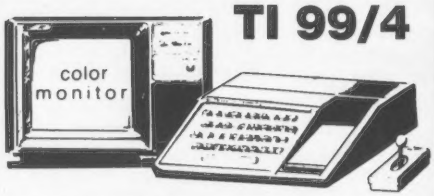

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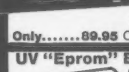

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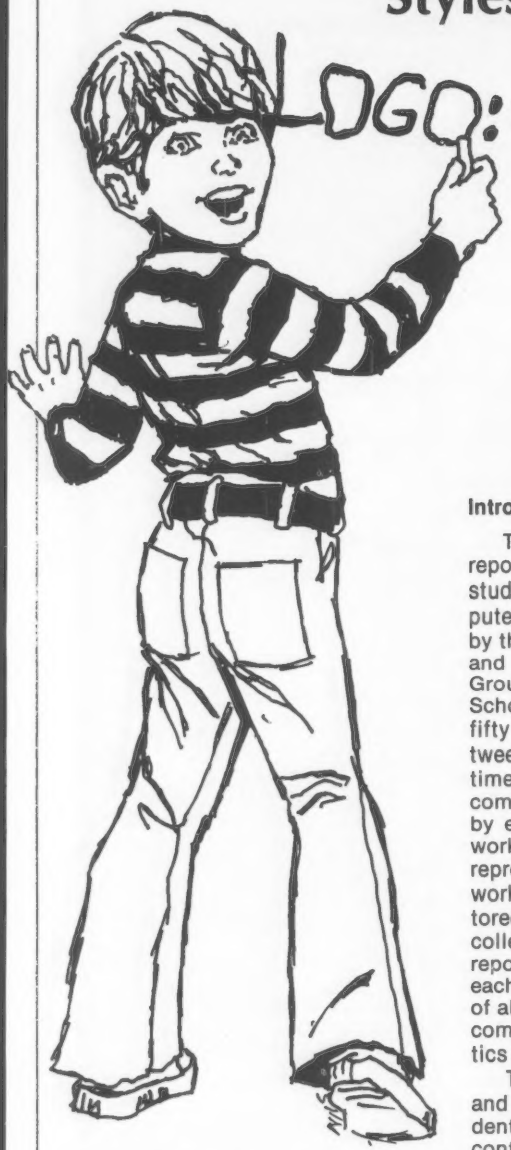
A Comparison of the Problem Solving Styles of Two Students Learning LOGO: a Computer Language for Children

Daniel H. Watt



The work reported in this paper was supported in part by the National Science Foundation (under grant number 77-19083SED) and conducted at the Artificial Intelligence Laboratory, Massachusetts Institute of Technology, Cambridge, Massachusetts. The views and conclusions contained in this paper are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the National Science Foundation or the United States Government.

Daniel H. Watt, Visiting Research Associate, Division for Study and Research in Education, LOGO Group, Massachusetts Institute of Technology, 545 Technology Square, Cambridge, MA 02139.

Introduction

This paper is one of a series of reports resulting from an 18-month study of an elementary school computer laboratory.[1] The study, funded by the National Science Foundation, and carried out by the MIT LOGO Group in collaboration with the Public Schools of Brookline, MA, provided fifty sixth-grade students with between 24 and 36 hours of computer time and instruction in LOGO, a computer language designed for use by elementary school children. The work of sixteen of these students, representing a range of interests, work styles and abilities was monitored in great detail. From the data collected we have prepared a series of reports outlining in detail the work of each child, and analyzing the learning of all sixteen children in the areas of computer programming, mathematics and problem solving.[1,2]

The contrasting work of Donald and Deborah, two of the sixteen students is presented in this paper. The contrasts between the students give rise to a number of pedagogical questions and issues which will be considered in the concluding section.

The computer language, LOGO, was developed approximately eleven years ago as a vehicle by which children could learn computer programming, problem solving and mathematics in a learning environment that grew out of the cognitive psychology of Jean Piaget and an approach to the design of computer languages, based on ideas arising from work in Artificial Intelligence.[4,5,6] Children are typically introduced to LOGO by using the computer to control a "TURTLE," an imaginary creature which "lives" on a graphics display screen, the movement of which is controlled by commands typed at a keyboard; for example: FORWARD 100, BACK 50, RIGHT 90, LEFT 45, etc.

FORWARD 100 moves the TURTLE forward "100 TURTLE steps" and leaves a trace on the display screen, while LEFT 45 causes the TURTLE to rotate 45 degrees to the left. Drawing pictures with the TURTLE is an initial programming activity with an immense resonance for most children. Children can identify with the TURTLE, imagining themselves going through its motions, as it carries out a particular task. At the same time, controlling the TURTLE becomes a metaphor for controlling the computer itself. Like the TURTLE, the computer responds to an ordered series of commands, and to procedures, defined as series of commands.

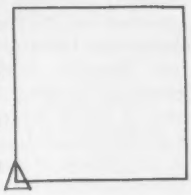
The way in which the action of the TURTLE can lead to a geometric design, as well as the method used by children to define procedures is illustrated in the following simple examples. Having drawn a square by repeating the steps, FORWARD 100, RIGHT 90 four times, a student can define a procedure by choosing a procedure title (BOX, for example) and typing a series of commands in order.

When the student types the new command, BOX, the shape shown in figure 1 will be drawn on the display

LOGO, con't...

Figure 1

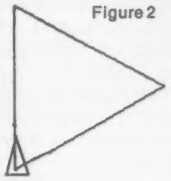
```
TO BOX
10 FORWARD 100
20 RIGHT 90
30 FORWARD 100
40 RIGHT 90
50 FORWARD 100
60 RIGHT 90
70 FORWARD 100
80 RIGHT 90
END
```



screen. (The small triangle shown in figure 1 represents the TURTLE). A similar procedure, TRI, could be defined as follows:

Figure 2

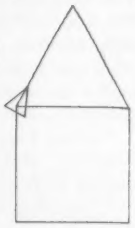
```
TO TRI
10 FORWARD 100
20 RIGHT 120
30 FORWARD 100
40 RIGHT 120
50 FORWARD 100
60 RIGHT 120
END
```



Having defined procedures BOX and TRI, the student can now use these as commands to the computer, in effect developing his own "private language" as he goes along. In particular, they can easily be used as subprocedures in creating the drawing, HOUSE, or the abstract design, FLOWER.

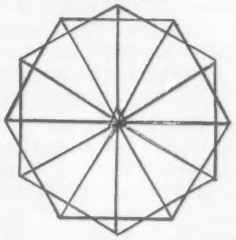
Figure 3

```
TO HOUSE
10 BOX
20 FORWARD 100
30 RIGHT 30
40 TRI
END
```



```
TO FLOWER
10 REPEAT [TRI RIGHT 30] 12
END
```

Figure 4

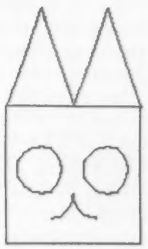


These TURTLE commands, when embedded in a suitable interactive, procedural computer language such as LOGO, provide the basis for a rich universe of activities called Turtle Geometry, which includes cartoon drawings, simple and complex geometric designs, mathematical theory building, and computer games and animation. Extensions of Turtle Geometry have proven fruitful when used with advanced high school students or MIT freshmen and sophomores. The universe of turtle geometry provides a conceptual framework for such aspects of mathematics as coordinate systems, positive and negative numbers, the use of variables, symmetry and similarity, the significance of special angles (30-60-90, 180, 360, etc.). The computer programming involved in beginning LOGO activities can include the notion of procedures and subprocedures, recursion and iteration, the naming of procedures and variables, the use of conditional logic in the form of simple "stop rules" for repetitive procedures, the understanding of procedural hierarchy, and the use of "debugging" strategies.

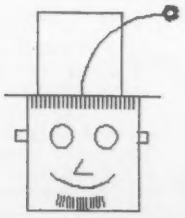
Within the "universe" of turtle geometry there is room for different students, working individually, to create their own sub-universes or "microworlds" with their own limited but expandable set of concepts, and related activities and projects. The pedagogy of a LOGO classroom can be seen as the task of helping each child to create, explore and extend his or her own "microworlds." In this paper we describe the "microworlds" of two students, Deborah and Donald, who approached a very similar project, in very dissimilar ways. We feel that by focussing on these two individuals we can demonstrate how the computational environment of LOGO fosters the learning of children with very different developmental levels, learning styles and academic abilities.

Figure 5

```
TO RABBIT
 5 HAT
10 LITTLE EYES
15 FACE
20 PENUP
25 FORWARD 70
30 FORWARD 3
35 RIGHT 20
40 PENDOWN
45 EARS
50 RIGHT 90
55 FORWARD 50
60 FORWARD 3
65 FORWARD 60
70 FORWARD 5
75 FORWARD 3
80 RIGHT 90
85 RIGHT 20
90 EARS
END
```



```
TO HEAD
 1 BOX
 2 EYES
 3 NOSE
 4 MOUTH
 5 BEARD
 6 HAIR
70 EARS
80 HAT
85 FLOWER
END
```



A Comparison of Donald and Deborah's Work

Deborah and Donald each carried out one major project as part of their LOGO experience. They each programmed the computer to draw a cartoon-like "head." Both projects, and the superprocedures used to draw them are shown in figure 5.

Deborah is considered by her teachers to be a "slow learner." In her regular classes she often appears to be withdrawn, unrelated to the subject matter or to her fellow students. When she began work in LOGO, she was totally dependent on the teacher — requiring his reassurance on matters as routine as when to type a carriage return.

Deborah was able to slowly build her confidence and understanding by limiting her choices of LOGO commands and inputs, limiting the goals of her work, and by working in a way that minimized the chances of error. While Deborah began her LOGO experience by asking for help at literally every turn, she had a deeply ingrained resistance to new ideas or concepts. For a long time she rejected the use of subprocedures, which could have greatly expanded her possibilities. It was as though she deliberately provided herself with a very definite and restricted "microworld" in which to operate.

Deborah used as few different commands as possible in her work. Basic turtle commands along with arc primitives RARC and LARC were almost the only commands she used. For inputs to TURTLE commands, she used only multiples of 10, up to 100. If a larger effect was needed, she would use two steps, as in FORWARD 90, FORWARD 30.

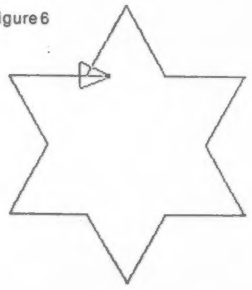
Deborah began by using only inputs of 30 for all TURTLE commands, and gradually expanded to include other numbers, while continuing to use 30, 60 and 90 as her favorites. This "microworld" which Deborah chose for herself, is very nearly as rich as all of Turtle Geometry. It includes squares, triangles, "circles" "stars" "men" "rabbits," and a variety of abstract designs, as well as the mathematical concepts of perpendicularity, inverse operations, the total turtle trip theorem, symmetry, similarity, estimation of lengths and angles, planning and debugging, and procedure writing.

LOGO, con't...

By limiting her inputs to numbers such as 30, 60 and 90, Deborah actually enhanced the possibility that random explorations would produce interesting results. At the same time, she seemed to have a high degree of visual intuition, often choosing precisely the correct input to produce a desired effect. Her patience in a one-step-at-a-time mode of operation was remarkable. Her format was quite stereotyped. (1) carry out one turtle step (turn, move or penup); (2) check to see if that looks right on the screen; (3) if so, write down the step and continue; (4) if not, clear the screen, retype all the steps previously written down and try another choice for the questionable one; (5) when a design looks good, choose a name for it, and copy all the steps to make a procedure.

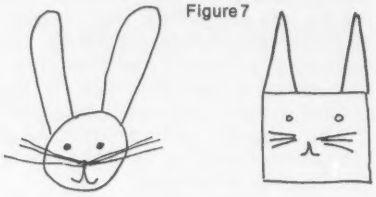
As an example of Deborah's success with this approach, we examine the way in which she drew a six-pointed star without making a single mistake. She began by turning the turtle RIGHT 30, and used a combination of FORWARD 70s and RIGHT 60s to complete the star. The actual rotations required to construct the star were RIGHT 120 at each point, and LEFT 60 at each inner vertex. The way Deborah accomplished these rotations was quite typical of her work. After each forward step, Deborah would turn the TURTLE RIGHT 60. She kept turning it RIGHT 60, until the TURTLE was headed in what seemed to her to be the right direction. This required two repeats of RIGHT 60 at each point, and five repeats of RIGHT 60 at each inner vertex. At one inner vertex she missed the correct orientation, and calmly repeated RIGHT 60 a total of eleven times until the TURTLE was aimed in the right direction. When she copied the steps in her notebook, she copied all eleven RIGHT 60s without any hesitation.

Figure 6



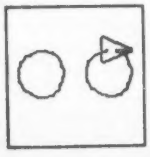
It was not quite late in the series of classes that Deborah was ready to undertake a major project. She drew a picture of a rabbit in her notebook, and asked the teacher if he thought that would make a good project. He suggested modifying the rabbit, to make use of straight rather than curved lines, and helped her redraw the picture in a more simplified form.

Figure 7



Although Deborah began by trying to draw the rabbit as a long series of commands, she soon accepted the suggestion that she break the problem into parts, and make each part a separate subprocedure. Although her work was directed toward an overall goal, and involved a certain amount of "top-down" planning, she constructed each part of the rabbit piece by piece, in an exploratory fashion. Once again her choice of inputs to FORWARD and RIGHT commands were such that it was relatively easy for her to make the design come out the way she wanted. Without any apparent planning, she chose the length for the sides of the rabbit's head (FORWARD 90 FORWARD 30) in a way that made it easy for her to locate the eyes and nose symmetrically. To locate the eyes she positioned the TURTLE at one side of the head, and moved it FORWARD 30. Deciding that that "looked like the right spot for an eye," she drew a circle of radius 20. She then moved the TURTLE twice more in steps of FORWARD 30, decided that that looked about right for the second eye. Thus she was able to locate both eyes symmetrically. It was apparent that she had not **decided** that the rabbit's head was 120 steps across, and that she could therefore locate the eyes symmetrically 30 steps in from each edge. More simply, she "knew" that 90 and 30 were "useful numbers" and that if she kept trying FORWARD 30 "it ought to come out right."

Figure 8



With the completion of her rabbit project, Deborah had almost totally reversed her initial feelings of dependence and incompetence. She invited her parents, teachers and school principal to visit the computer lab, and in many ways, demonstrated to her visitors and classmates her new found sensè of confidence, satisfaction and power.

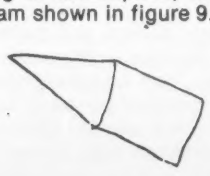
Donald's work, which provides a striking contrast to Deborah's, was characterized by a strong component of advance planning, and the creating of structures within which problems could be solved. At the same time, Donald was quite ineffective at the visually-based, exploratory modes of problem solving which were so useful to Deborah. He had difficulty estimating angles, and making use of the visual feedback provided by his explorations to improve his next attempt.

Throughout his work Donald was extremely receptive to suggestions from the teacher, often making use of new ideas before he fully understood them. In this way, he was able to incorporate into his way of working, strategies that would continue to prove useful, as he gradually came to understand them through use in more than one context. He seemed to have the confidence that he could make use of the teacher's suggestions effectively and that he would eventually understand them, even if the concepts were a bit hazy at first.

As an example of both the effectiveness and teh difficulties associated with Donald's structured planning approach as well as the frustration he experienced with visual approaches to problem solving, we consider his construction of a "house" from a square and a triangle, a common LOGO task, tackled by many students at an early stage of their LOGO experience.

At first Donald attempted an exploratory approach to solving this problem. He began by having the TURTLE draw a triangle on the screen, making use of the TRI procedure described above. Having started by drawing a triangle, Donald established a "framework" for solving the problem corresponding to the initial orientation of the triangle. Asked to draw a picture of what he was trying to accomplish, he made the diagram shown in figure 9. Since

Figure 9



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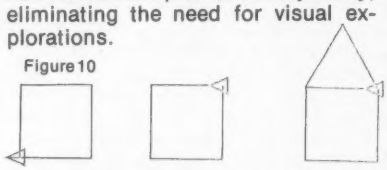
he was now dealing with **two** disorientations, the gap between the TRI and BOX procedures, and the tilted orientation of the entire shape, Donald had more difficulty than he could handle, and in an hour of exploration, never succeeded in resolving the problem in this form.

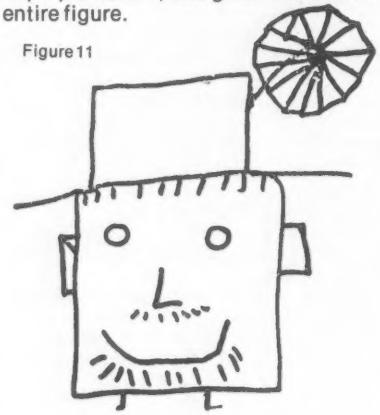
At the next class, the teacher suggested that Donald draw the BOX first. This suggestion provided him with enough new insight to devise a plan for solving the problem. Donald's plan allowed him to avoid the usual problem of finding the rotation needed to attach the triangle to the upper left hand corner of the box. Instead, he moved the turtle to the upper right hand corner of the box, reversed its direction, and then drew the triangle so that its first side was along the top of the box. In this way he resolved the problem analytically, eliminating the need for visual explorations.

Figure 10



Donald's HEAD project occupied him for more than 12 class periods — more time than any other student devoted to a single project. This project also began with a plan, a cartoon-like drawing of a man's head, which formed the basis of Donald's work. After one session of exploratory work, Donald drew a revised plan, and worked with his teacher to create a superprocedure, designed to draw the entire figure.

Figure 11



Donald's original superprocedure, TO HEAD, included the first six features of the head: the outside (BOX), EYES, NOSE, MOUTH, BEARD and HAIR. Once the superprocedure was written, each subprocedure became a mini-project, requiring one or two classes to resolve. Each feature of the head required it's own "construction plan," a combination of the analysis and exploration needed to carry it out. While working on the features of his head, Donald made use of a great deal of teacher assistance, especially in developing approaches to geometric analysis that were necessary to overcome his difficulties with visual problem solving.

When Donald came to his subprocedure, EYES, for example, he could not resolve the problem of how to locate the eyes symmetrically, by means of visual exploration. After several unsuccessful attempts, he asked for advice from the teacher. The teacher helped him set up a kind of "grid" with which he calculated the location of the eyes, and he was then able to solve this problem without any further difficulty.

Other, more complex problems that Donald encountered in the course of the project were resolved in similar fashion — by creating "structures" which enabled him to solve the problem analytically and avoid visual explorations. In the course of his work Donald encountered estimation of distances and angles, the geometry of arcs and circles, the total turtle trip theorem, and the use of both grid-based and intrinsic coordinate systems. He learned to use subprocedures and sub-subprocedures, to use patterned procedures making use of a REPEAT command, to make use of variables to control the size and shape of his "hat" and "flower" and to use a procedure with a conditional stop rule. Although Donald only "learned" these approaches to the extent necessary to solve the particular problems inherent in his project, each succeeding use of the same concept, reinforced his exposure to it, deepening his sense of mastery.

Donald's final figure, drawn by the superprocedure, HEAD, represents an almost literal mapping of his revised plan, figure 11, into a computer program.

Conclusion

In summary, we observe that Deborah's and Donald's problem solving styles were markedly different in several ways:

1. Planning
Donald was a "planner." He made an overall plan for his project, and created separate plans for each subpart of his project. Deborah had an overall idea of what she was trying to accomplish, but her actual project was carried out in an exploratory manner, one step at a time. Donald's superprocedure HEAD, was written to serve as a framework for his project; Deborah's superprocedure, RABBIT, was written as the final step in completing her project.
2. Analysis vs. Intuition
Deborah relied on an accurate visual intuition and a very limited set of inputs to TURTLE commands; Donald's visual intuition was poor. He relied on mathematical analysis to resolve each problem he faced.
3. Comfort With New Ideas
Donald absorbed a great deal of new information and tried a number of new approaches as he carried out his project — confident that he could learn the skills he needed as he went along; Deborah resisted new learning — her learnings consisted largely of consolidating and reinforcing old skills and methods.
4. Obtaining Assistance From A Teacher
Donald made regular use of assistance from his teacher, while Deborah insisted on "doing things in her own way," and resisted suggestions which she did not fully understand.

The observed differences give rise to pedagogical questions that are not limited to teaching children to use computers: How can teachers learn the learning styles of their students? How can teaching approaches in normal classes be flexible enough to support such a wide variation in learning styles? How can a teacher help Deborah acquire some of Donald's analytic approach? Can Deborah's intuitive understanding be learned by Donald?

The success of both Donald and Deborah in a LOGO environment leads us to believe that additional experience in such an environment may be productive in beginning to answer these questions. □

Footnotes

1. "An Assessment and Documentation of a Children's Computer Laboratory," LOGO **Memo** 48, 1977.
2. "An Interim Report of the Brookline LOGO Project," LOGO **Memo** 49, 1978.
3. "Final Report of the Brookline LOGO Project," to be published Spring, 1979.
4. "Programming Languages as a Conceptual Framework for Teaching Mathematics." Feurzeig W., Papert S.A., Bloom M., Grant R., and Solomon C. Report No. 1889. Bolt, Beranek, and Newman. Cambridge, Massachusetts. 1969.
5. "Twenty Things to do With a Computer." Seymour Papert and Cynthia Solomon. LOGO **Memo** 3, June 1971.
6. "Teaching Children to be Mathematicians vs. Teaching About Mathematics," Seymour Papert. LOGO **Memo** 4, July 1971.
7. **Turtle Geometry**, Abelson and diSessa, to be published by MIT Press in 1979.

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Sine POLYs: Some Geometrical Explorations

Neil Rowe

Analytic geometry on the computer doesn't have to be just drawing graphs of known functions. Here are some simple but powerful things to explore.

I use abstract things called "turtles" to draw the patterns. That is, things that can either go FORWARD a specified distance, drawing a line, or turn RIGHT a specified angle in degrees. The classic "turtle" program is called POLY, and consists of repeating over and over again the pair of instructions.

```
FORWARD S
RIGHT A
```

where S and A are some numbers. For instance, if A = 90 degrees, it's a square; if A = 60 degrees it's a hexagon. S just controls the size of the drawn figure. This program will draw all regular polygons and regular "stars". Note when S and A are both small, the angles of the figure are hard to see, and you'll appear to be drawing a smooth circle.

Figure 1: AMPOLY, K = 1 and A = 1.

In what follows we'll consider programs of the POLY form, but where sines and cosines are involved.

1. AMPOLY

Consider repeating forever:

```
FORWARD SIN(T)
RIGHT A
ADD A TO T
```

or equivalently:

```
FORWARD SIN(HEADING)
RIGHT A
```

where HEADING is a variable representing the total amount the turtle has turned right since it started. (Note that a heading of 360 degrees may look like a heading of 0, but we consider them here two different things.) The above program draws a cycloid (Fig. 1).

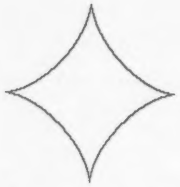

Figure 2: AMPOLY, K = 2 and A = 1.

Similarly,

```
FORWARD SIN(K * HEADING)
RIGHT A
```

and related programs draw cycloid-like closed figures (Figs. 2-4). (The * stands for multiplication.) I call this program AMPOLY because it's a POLY whose FORWARD step size is being "modulated" at some frequency.

Figure 3: AMPOLY, K = 4 and A = 1.

2. FMPOLY

You can also have a "frequency modulation" POLY:

```
FORWARD S
RIGHT (CF + (MI * SIN T))
ADD MF TO T
```

where CF denotes center frequency, MF modulation frequency, and MI modulation index ("How much" modulation you want). For small S in these programs, the amount of curvature of a circle is varied periodically, so when MI is small they look close to circles. See Figs. 5-9 for examples.

Figure 4: AMPOLY, K = 1 and A = 3.

3. HSQUARE

There are lots of interesting variants on the preceding. One of my favorites is the repeated loop.

```
FORWARD SIN(HEADING + HEADING
RIGHT A
```

These designs (see Figs. 10-12) show many interesting symmetries, and are highly varied for different values of A.

Figure 5: FMPOLY, CF = 2, MF = 8, MI = 2.

4. More Familiar Curves

Turtle programs of this form can also draw some of the familiar curves of Cartesian geometry. For instance, a parabola (Fig. 13):

```
FORWARD S
RIGHT (SIN(HEADING * SIN(HEADING) * SIN(HEADING))
```

or a hyperbola:

```
FORWARD S
RIGHT (SIN(HEADING) * SQUAREROOT(SIN(HEADING)))
```

or an exponential curve:

```
FORWARD S
RIGHT (SIN(HEADING) * SIN(HEADING) * COS(HEADING))
```

5. Some Questions To Explore

(a) Why does AMPOLY have K "points" if K is an odd integer greater than 1, but 2K if K is even (K > 1):

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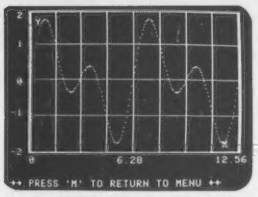

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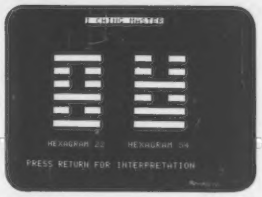

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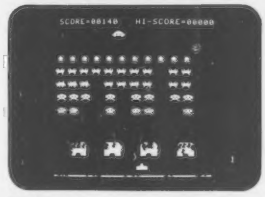

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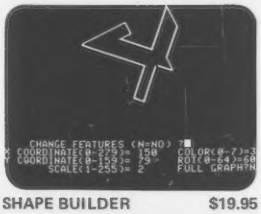

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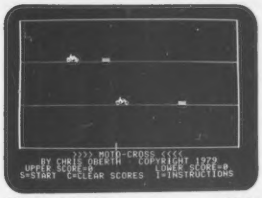

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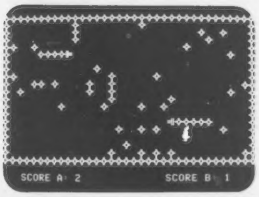

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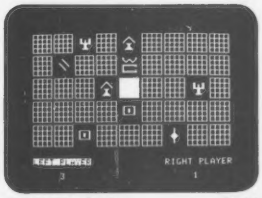

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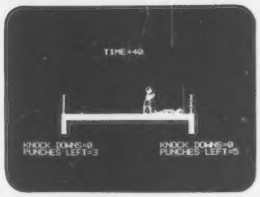

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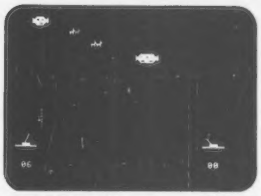

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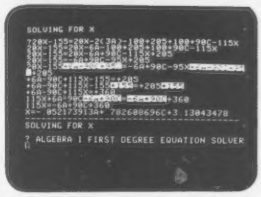

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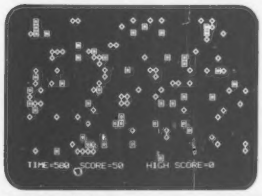

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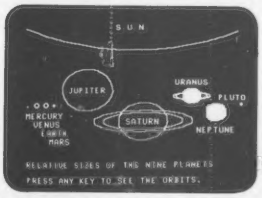

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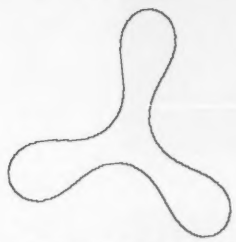

Figure 6: FMPOLY, CF = 2, MF = 6, MI = 8.

(b) AMPOLYs can also be drawn by another quite different program. It's generally called DUOPOLY, and consists of the repeated loop:

```
SET HEADING TO BE H1
FORWARD S1
RIGHT A1
SET H1 TO BE HEADING
SET HEADING TO BE H2
FORWARD S2
RIGHT A2
SET H2 TO BE HEADING
```

Among other things, this program can draw hypocycloids and epicycloids, figures representing the addition of two circular motions where the rate of circumference travel is the same for both. Show that AMPOLYs are hypocycloids and epicycloids, and find the exact relationship between the AMPOLY arguments and the parameters of the circular motions. (You might want to do reading about amplitude modulation.)

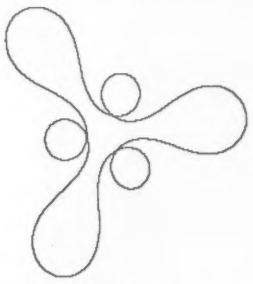

Figure 7: FMPOLY, CF = 2, MF = 3, MI = 9.

(c) DUOPOLY (see above) draws ellipses when A1 = -A2. Find out why. Then investigate why FMPOLY when MF = 2 * CF, the repeated loop

```
FORWARD SIN(HEADING)*SIN(HEADING)
RIGHT A
```

and the repeated loop

```
FORWARD(1 + (COS(2 * HEADING)))
RIGHT A
```

all draw things that look sort of like ellipses but not quite. (You might want to do some reading about frequency modulation, and you might try the preceding question first.)

(d) One interpretation of that last variant in the preceding question is that the turtle is "going against a grain" when it moves at HEADINGs near 90 and 270 degrees as opposed to 0 and 180 degrees, so it can't go as far per each "step". Investigate other such figures of the form

```
FORWARD(1 + (B * COS(C * HEADING)))
RIGHT A
```

Why is the figure closed for B = 1 and C = 2 but not for B = 1 and C = 1?

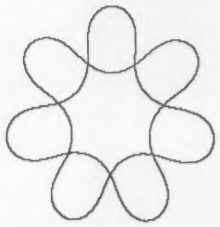

Figure 8: FMPOLY, CF = 2, MF = 7, MI = 8.

(e) (for people who know some physics) Try to model a "turtle on a sloping plane" where the amount of effort the turtle must exert against gravity and friction per each "step" it takes is constant (hence step size must vary with direction). Try drawing some figures on this slope and see how they're distorted. Maybe try some irregularly sloping surfaces.

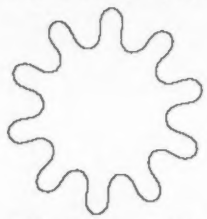

Figure 9: FMPOLY, CF = 2, MF = 20, MI = 30.

(f) Suppose you write a program for a turtle in one of these "warped" or "sloped" worlds. How can such a turtle compensate so as to draw the correct thing, even when it doesn't know exactly how it's being warped? (Maybe use drawing a POLY as an example. You might want to read about numerical analysis.)

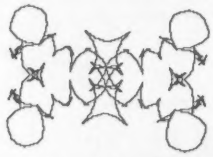

Figure 10: HSQUARE, A = 17.

(g) Why is the following repeated loop a closed figure only when P is even?

```
FORWARD(SIN(HEADING) TO THE PTH POWER)
RIGHT A
```

(Assume A is not 0).

(h) What is the rotational symmetry of an FMPOLY figure in terms of CF, MF, and MI? Can you relate it to the rotational symmetry of POLY?

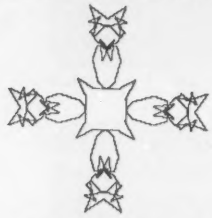

Figure 11: HSQUARE, A = 34.

(i) Prove that HSQUARE always has both horizontal and vertical bilateral symmetry for any integer A.

(j) HSQUARE can also have rotational symmetry in addition to bilateral symmetry (as Fig. 12, which has rotational symmetry of order 4). Develop a general method for predicting this as a function of integer A.

(k) Why is it that the only HSQUARE figures that are not closed are for A a multiple of 8? And why not all multiples of 8?

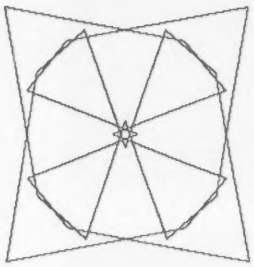

Figure 12: HSQUARE, A = 20.

(l) (for people who know some calculus) Show that any curve f(x) can be drawn by the repeated turtle loop.

```
FORWARD 1
RIGHT -(SIN(HEADING) * SIN(HEADING) * SIN(HEADING) * f''(x))
```

where f''(x) is the second derivative of f(x) with respect to x. Use this formula to draw arbitrary functions of your choice. (Note that often it's possible to express f''(x) as a function of HEADING, as in the case of the parabola, hyperbola, and exponential curve examples given before.)

(m) How is it that the above formula draws a curve knowing only the second derivative? Don't you "lose information" in finding the derivatives, and don't many functions have the same second derivative? — for instance, x(x-1) (x + 1), (x-1) (x + .85i + .5) (x-.85i + .5), and x*x*x all have 6x.

Sine POLYs, con't...

Figure 13: parabola.

(n) Use (1) to find the "mystery curve" (Fig. 14) drawn by

```
FORWARD S
RIGHT SIN(HEADING)
```

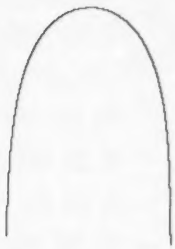

Figure 14: curve for question (n).

For hints on the questions, write to the author at Department of Computer Science, Stanford University, Stanford CA 94305. For many more ideas about turtle drawings, see a forthcoming book, **Turtle Geometry**, by Hal Abelson and Andy DiSessa. □

While LOGO will probably not replace BASIC, it is still an outstanding simple, one-command language which young children can understand and learn quickly. For readers unfamiliar with LOGO, we recommend the following articles:

1. "Turtle Geometry Without Hardware" by McLean and Pagano, Creative Computing, Vol. 1, No. 5 (pp 29-31) or Best of Creative Computing, Vol. 1, (pp 186-188).
2. "Twenty Things To Do With Your Computer" by Papert and Solomon, Educational Technology, Vol. 9, No. 4 (pp 39-42).
3. "Toward A Human Computer Language" by A.B. Cannara, Creative Computing, Vol. 1, No. 5 (pp 38-40) or Best of Creative Computing, Vol. 1, (pp 58-60).
4. "Grammar As A Programming Language" by N. Rowe, Creative Computing, Vol. 4, No. 1, (pp 80-85).
5. "A Comparison of the Problem Solving Style of Two Students Learning LOGO" by Daniel Watt, Creative Computing, Vol. 5, No. 12.

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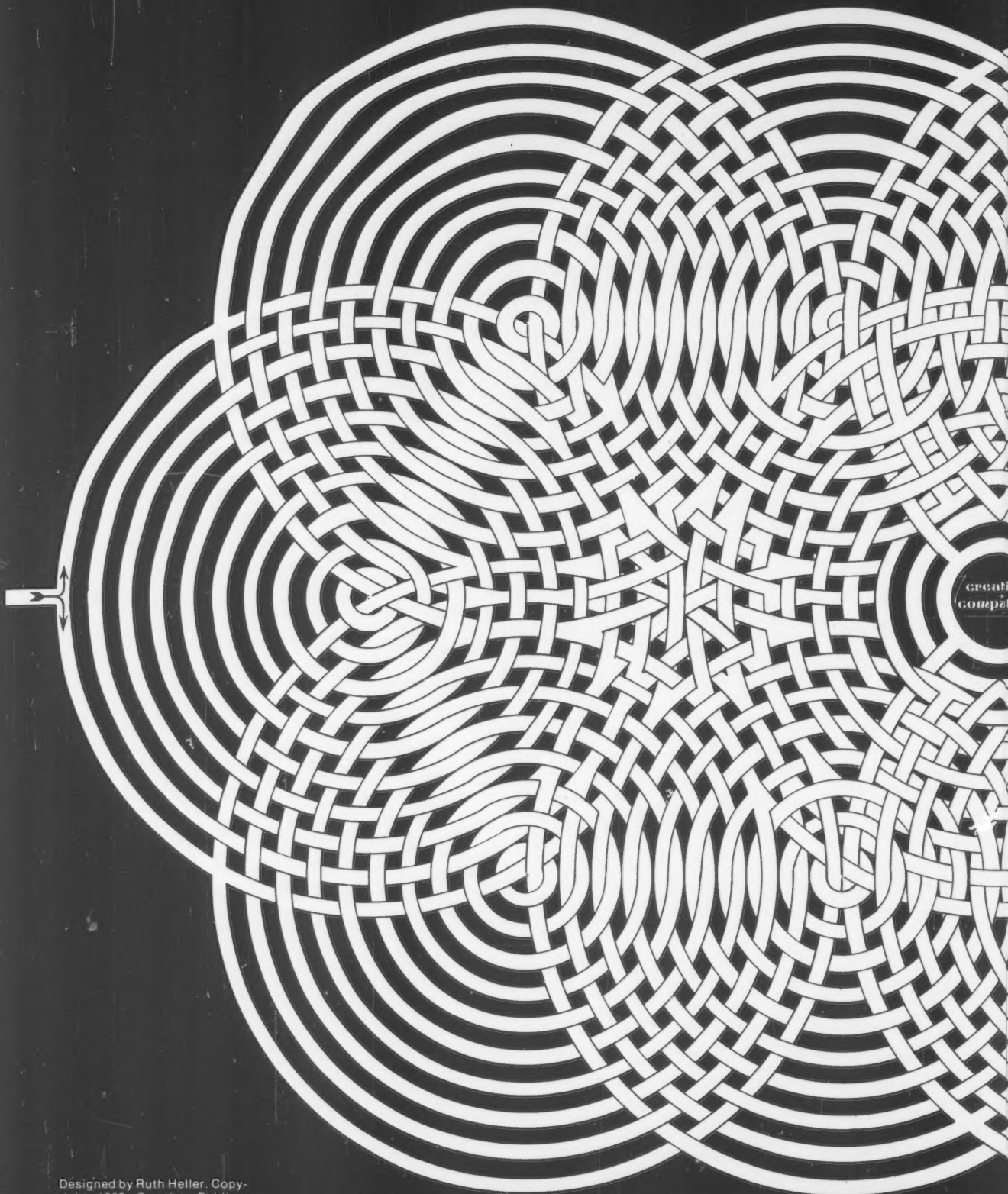

weave under and over, backtrack or branch off, but
begin at the top each time and exit a

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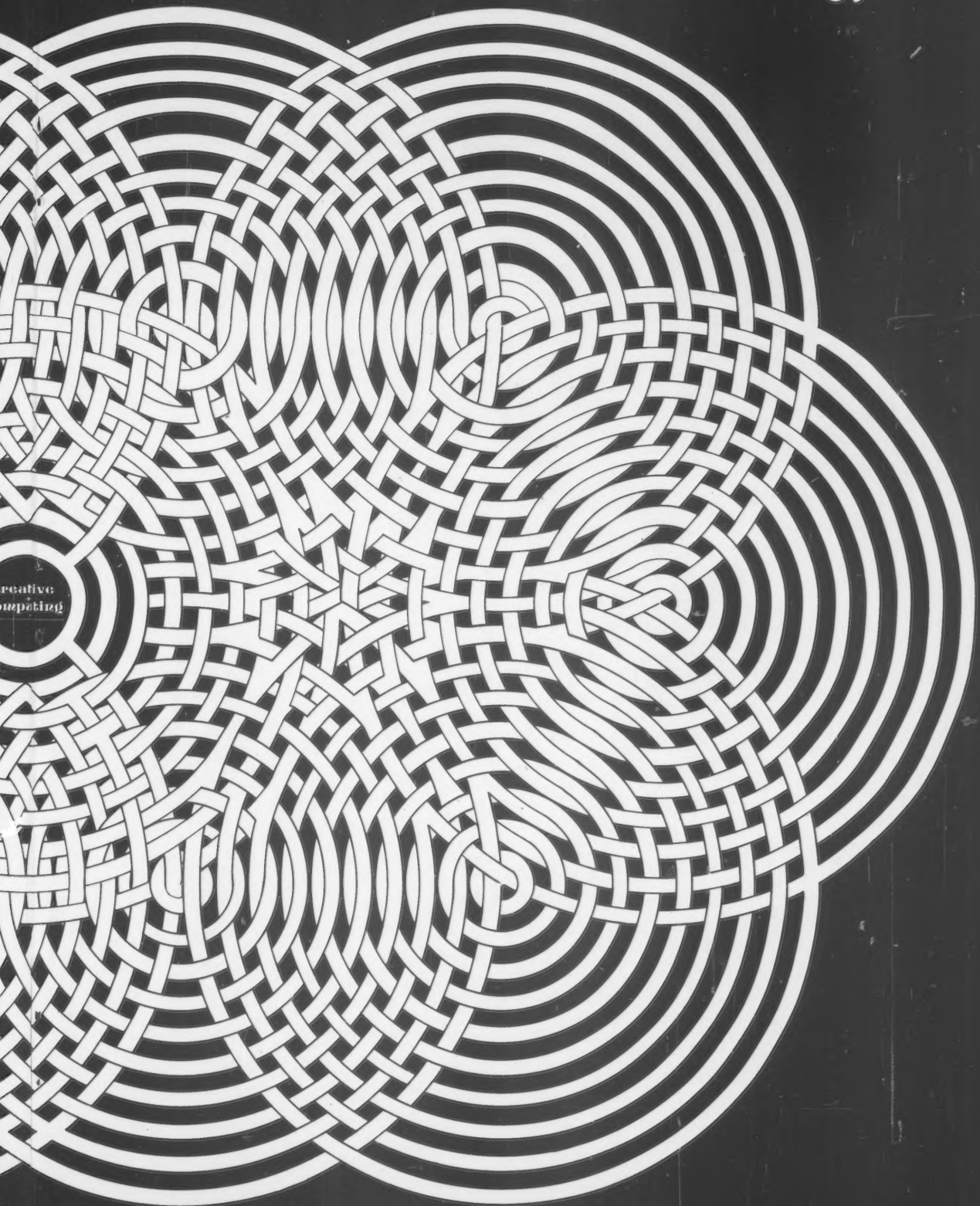

but stay on the same path until you enter the center.
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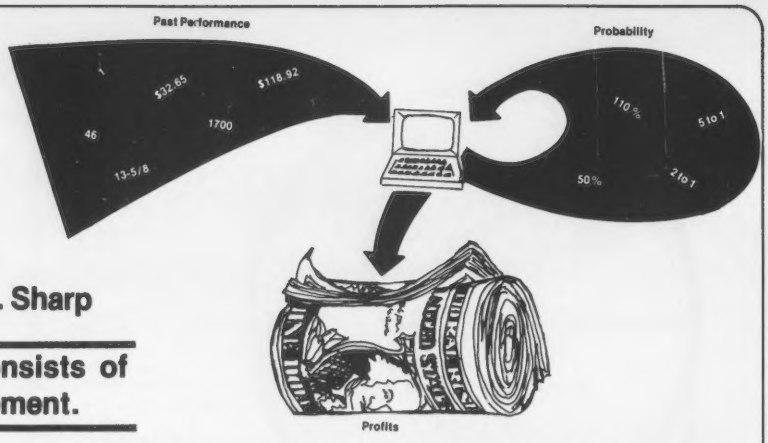


The investment problem consists of selection and money management.

Applying computers to investment problems is a natural alliance, typified by accounting systems, information retrieval and screening of stock selections by user given criteria. The advent of the microprocessor extends that use to an intimate, interactive arrangement between the individual investor and his computer, enabling theory testing and game playing with investment opportunities. Ideas can be quickly explored in a laboratory environment before hard cash is risked on an unproven thesis. The following discussion illustrates the interfacing of the microprocessor to records of past performance to yield probabilities and then managing those probabilities to produce profit.

The investment problem consists of selection and money management. Selection is an art with small expectations while money management is a science capable of pyramiding a small advantage into significant profits.

First, let's look at the selection process. There are two major factors requisite to successful selection: Market direction and intrinsic value (quality) of the investment. Market direction tends to dominate but is more reversible and consequently is ignored by some investors who assume that quality stocks will eventually progress with good market conditions. I believe in determining odds of market advance and hedge investments accordingly, removing some risk when odds appear to be poor and leveraging heavily when odds appear to be favorable. The obvious question at this point is how do you determine the odds?

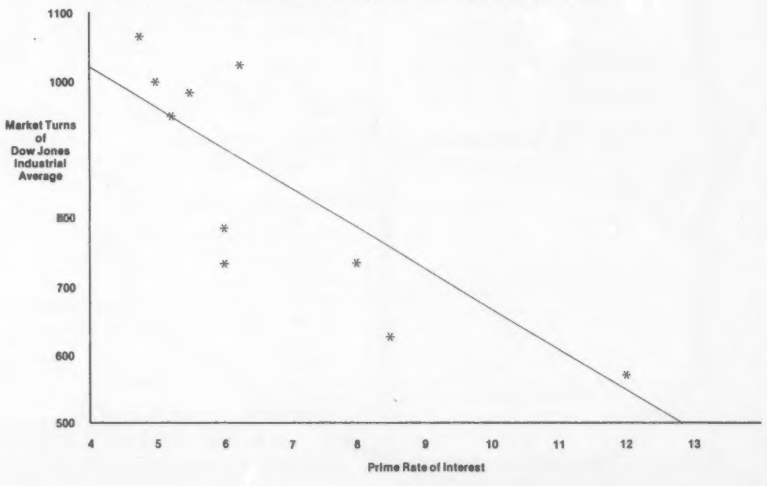
There are two theories concerning market movement:

1. An efficient market correctly representing current values under given economic conditions, and
2. A market of random movements behaving more or less like a roulette wheel.

I think that both are correct in a combination that develops as follows:

The market is obviously affected by economic conditions, particularly the availability of money, although it doesn't step precisely in time with those conditions. Random events, user psychology, etc. tend to create a random walk around the bias line dictated by the economic environment. The trick is to determine the bias line and the odds of significant departure in either direction from that line. The problem simplifies with selection of predictor variable(s) that are themselves more predictable and readily available (documented). Now the computer becomes useful as you employ regression analysis to inspect and discard a number of economic indicators to determine their relationship with market turns. My own microcomputer analysis of the period since the prime rate has been allowed to float indicated the prime rate as highly correlated with the market movement. (Exhibit 1). Remember, we are still in the art phase, so you may select other variables. The prime rate is a much smoother changing variable than the Dow Industrial average and tends to reach high points ahead of the Dow reaching bottoms (12% in July, 1974 and market bottom in December). When given a set of points, e.g., prime rates near turning points in the Dow Jones Industrial Index, Regression Analysis measures the effect the predictor (prime rate) has on the response variable (Dow Average) by a coefficient of correlation and computes a line of regression that best fits the given points. If you can estimate the extreme value of the prime rate, then the program returns a forecast of the turning points in the Dow Average and plots the given points and regression line for visual assurance (Exhibit 1).

Exhibit 1. Scatter Diagram with Progression Line
Dow Jones Industrial Average As A Function of Prime Rate of Interest



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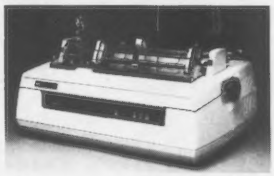

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Having used regression analysis to satisfy myself that the prime rate of interest was a good measure of economic influence on the market, I decided to apply random (unpredictable) daily fluctuations to the regression line constructed with prime rates. Using the RND function, I generated two sets of random numbers. The first set was partitioned into direction (up or down) of market movement proportionate to the expected change produced by the prime rate.[1] The second rate is the absolute amount of daily change of the Dow Industrial Index in the same percentages as actually occurred in the year 1967.[2] This then becomes a model of the stock market that combines economic influence as measured by the Prime Rate of Interest and a daily Random Walk, unpredictable but governed by the laws of random events. Each execution of the model creates a unique possibility for market movement.

We now have stock market simulation but how do we use it?

The answer is that we treat it just like scientists would treat a weather or traffic simulation. That is, we study it for extremes and repetition that establishes probabilities for a certain level to be reached (60% chance of rain today!). The extremes allow us to set our defenses against a market that falls completely out of bed, while our investment strategy can be adjusted to the probabilities of a favorable investment climate. It is fascinating to see how far the market can wander from the line of bias, but run enough cases and the probability pattern begins to emerge. Once the odds are established and when the edge is in your favor, then we look at the individual stocks.

There are many methods for screening stocks, some of which are hard to quantify and hence difficult to place on the computer. One quantifiable method was discussed in **Business Week** and has been incorporated into my investment package.[3] This routine combines book value of the stock with current money rates to establish a market value. My experience indicates it works well with established, less volatile stocks, but no so well with others. The art becomes very foggy, but your micro shines some light for you as you use this routine as one more check of intrinsic value on your "hot stock." I combine this with other factors such as price compared to past cyclical extremes, price earnings ratios, product potential, etc., to estimate a "floor" price and a "potential" price. The differences between current price and potential divided by the difference between current price and floor is my expectation factor. That ratio has to be better than 2 to 1 to even consider the stock further. The more extreme this ratio (undervalued) the more money I invest (bet) on this stock; and that leads us into money management.

Before you can manage anything you have to understand it. That means reviewing past performance. If you want to understand the market, spend time in the library reading old **Wall Street Journals** until you find a period of time that has roughly the same concerns that we encounter today. If you want to adopt an investment philosophy look at your past record to secure the successful and work on the failures. Analyze your investment transactions for percentage of successful selections, time spent with both succeeding and failing ventures and annual rates of return netted. Look at commissions to see if churning your account ate away your profits. Most investors will probably learn that a good yielding investment socked away from sight would be the best course. However, if you intend to play the game know your numbers. For example, my success rate on selection has been 60.9 for nearly 20 years with hardly any variation. For some time though, I did not net enough profit to warrant my activity. I held losing situations too long (I'll sell as soon as I get even!), was too timid on good prospects and my timing was atrocious. I still pick at the 60.9 rate (art) but have significantly increased percentage profits (science). Specifically, the computer and I are concerned with the following money management matters:

Risk Analysis

One of the foremost principles of investment is to "protect your capital." A second useful concept is the application of leverage, i.e., borrowed money. The second item tends to aggravate the first. The solution is portfolio risk analysis using volatility factors, market expectations, margin maintenance rates and margin debt to determine threshold values where forced liquidation will begin. You must anticipate and have your investments maximized at market bottoms to maximize return. In 1974 I was continually in margin trouble but managed to struggle through fully invested, fully leveraged. The computer routines developed from that experience computes the market risk (beta) of individual stocks, combines them with the weight of each stock in your portfolio and then tells you what the portfolio value will be at certain market levels and what level will trigger the dreaded margin call. The routine allows you to iterate by selecting stocks for sale, recomputing expectations until you have found a combination that is comfortable.

Tax Analysis

The small investor must watch his commission situation carefully, avoiding odd-lots, buying higher priced stocks, buying fewer stocks to optimize the transaction amount; but as he becomes successful he must switch his alertness to taxes. The guiding principles become: every gain should be long term; every loss should be short term; your tax bracket must be continually in mind. The way to accomplish this is to have an up-to-date record of all yearly transactions and be ready to fill out the Form 1040 at the first hint of action. Terrible thought that it is, the computer can shorten this to a one minute process allowing you to check for the best year to liquidate your investment and giving your current tax brackets for both years as a result. With the change in tax law effected in November 1978, I wore this program out deciding whether to sell prior to November 1, prior to December 1, or after January 1. The action anticipated the same price received for my shares, as I went short against the box in October, and then decided when to deliver the stock for tax purposes. Computing next year's expected tax bracket allows you to analyze your borrowed money against net yield of income producing investments to see if you can make anything on the other fellow's money. It is great to borrow from Merrill Lynch at 12%, buy a utility, with a record of dividends being treated as tax deferred capital appreciation, having a face yield of 9.5% and knowing that Uncle Sam will give you enough credit on interest charges to net you over 2% on the borrowed money. You assume the risk for the investment but you also pocket any capital gain likely to accrue to a depressed issue. Since most stock dividends are only partially tax deferred the program produces a table given tax bracket, face yield, and current rate of borrowed money. Rows of data are produced, one for each ten percent of

Investment, con't...

tax deferred dividend and a very revealing analysis fails out of a messy calculation. (See Exhibit 2).

```
ENTER YIELD OF INVESTMENT? 9.5
ENTER RATE OF BORROWED MONEY? 12
YIELDS FOR THE 45 PERCENT TAX BRACKET
EXEMPT 1 NET YIELD 2 BREAK 3 GAIN 4
  0     5.225     9.5          -1.375
 10     5.6525    10.2773      -.9475
 20     6.08      11.0545      -.52
 30     6.5075    11.8318      -9.25007E-02
 40     6.935     12.6091       .335
 50     7.3625    13.3864       .7625
 60     7.79      14.1636       1.19
 70     8.2175    14.9409       1.6175
 80     8.645     15.7182       2.045
 90     9.0725    16.4954       2.4725
100     9.5       17.2727       2.9
```

1 Percentage that is deferred as capital gain.
2 Effective yield after 45 percent tax.
3 Comparable fully taxed yield.
4 Net returned to investor after tax applied.

Exhibit 2 TAX DEFERRED YIELDS

Time Related Investments

Time is money and most of us forget this when we hold a losing investment until it returns to what we paid for it. The comparison to be made is what value would the principal have compounded over the period of time we held the stock. Hence, your computer tool kit must have a compound interest routine which enables you to make comparisons. This is incorporated into an exchange analysis program to see if swapping investments would be profitable by comparing capital gains or losses after taxes, dividends anticipated and reinvestment of any differential between two investments. A microcomputer with BASIC can undertake this exercise without oversight or error.

Other Money Management Matters

Obviously there are money management techniques not discussed here. Having selected a stock and a total amount to commit to it, I like to buy 5-10 times over a 3-9 month period to average out fluctuations and give me time to confirm my initial impressions. This might be regarded as diversification of time and has been more effective for me than diversification of issues. I also like to set bids below the market with the assumption that any entry into a stock will occur between the high point or low point of a short range cycle and therefore the price will be better in the near future. I will not go into detail on this technique because I have not automated the process, but for some time I have been searching for an equation that ties the investment analysis into a neat package for a microcomputer. The variables would be: total money available for investment, market probability factor, tax bracket, cost of money; and a set of investment candidates with volatility factors, expectation factors, current prices and yields. The program would indicate stock purchases to be made and amounts of each. All artistic effort would be reflected in the inputs given and the management science would be assigned to the computer. Mundane matters of tax law and commission rates would become grist in the profit equation as your portfolio expands and contracts in reaction to expected changes in market conditions. Now this will be some program!

This concludes a very brief treatment of how your microcomputer may be applied to investment questions. I have found it to be a profitable application, but am convinced it is only indicative of better things to come. □

Footnotes

1. This bias can be changed to a different variable or line by replacing one statement in the program.

2. 1967 was used as I had a record of all daily changes and the range was representative of more recent trading years. The percentages are in table form in DATA statements and can be replaced.

3. "Inside Wall Street," **Business Week**. January 23, 1978.

Creative Computing Software now has available the investment analysis programs developed and used by Mr. Sharp on cassette tape for the TRS-80, Level I and II, 4K. This package CS-3305 (Investment Analysis) retails for $49.95.

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CIRCLE 205 ON READER SERVICE CARD

"Turn-Key" CP/M Systems

James J. Frantz

System power-up and loading procedures are almost too simple after implementing this technique. Perfect for small business (and home) applications.

The marriage of BASIC and Digital Research's CP/M has provided a powerful software team to the developers of business software. The hobbyist and the home computer game lover can also enjoy the result of this popular team. But, as the development of business systems reaches out to more and more users; ease of operation becomes more important.

As the development of business systems reaches out to more and more users, ease of operation becomes more important.

To bring a system up under CP/M after power-on is a multi-phased process and is not always easily performed by someone not accustomed to computer systems. As currently implemented, CP/M must first be loaded into memory from the diskette. This is normally very simple and involves inserting the diskette into the drive and depressing the "RESET" button. Once CP/M gets control, it responds with the "A>" prompt. The user must then type in the proper command. For most versions of BASIC the user must type a multi-word command in order to cause CP/M to load the BASIC which in turn will load and execute the desired program. In contrast to this elaborate procedure, most "big" systems immediately display a menu from which the user can select the desired program by entering the menu number. This minimizes, if not eliminates, the chance of typing errors. Why can't this be done with CP/M?

Well, it can. This article will describe how to make version 1.4 of CP/M start executing a program immediately after "RESET" is pressed. A menu program will also be provided that shows how this feature can be implemented with a game diskette. This technique was developed to allow my young daughter and her friends to select and run their choice of game from my collection of BASIC and machine language games without adult intervention. This same technique is even more suitable to business applications, especially dedicated systems.

CP/M Fundamentals

To understand how this works, the organization and operation of CP/M must be considered. CP/M is loaded into the top of existing memory from the diskette. There are various schemes used by vendors of disk systems which offer CP/M to accomplish this, but in every case CP/M begins execution after being loaded by entering at it's base. The base of CP/M is 2900H + b, where b is the bias determined by the amount of memory in the system. In a 16K system this bias is zero and a 32K system has a bias of 4000H. Starting at the base, CP/M is arranged as shown in Figure 1. The location of the input, or command buffer, and the storage location for the pointer to the command string are important in implementing automatic startup of a program.

Notice the zero byte at location seven. This zero tells CP/M that the command buffer is empty, i.e., there are zero characters in the buffer. The copyright notice which appears after the zero byte is over-written by whatever the user types after the "A>" appears on the screen. If this location contained something other than zero, CP/M would think that a command had already been typed, skip printing the prompt and begin processing the contents of the command buffer. By modifying the contents of the command buffer to contain a program name and changing the buffer length

Location 2900H+b+x (x)	Contents (Hex)	Description	Remarks
0 to 2	C3 55 zz*	JMP Instruction	Normal Entry Point
3 to 5	C3 51 zz*	JMP Instruction	Alternate Entry
6	7F	Max. Length of command buffer	Max. number of input characters allowed
7	00	Length of command string in buffer	Normally zero
8 to 23	20	ASCII blanks	
24 to 61	various	Copyright Notice	
62 to 135	00	Remainder of the command buffer	Initially Empty
136 & 137	08 (base)	Scan pointer Storage	Points location 8

*zz = 2900H + b + 0300H

Figure 1

James Frantz, 94-285 Hiwahiwa Pl., Waipahn, HI 96797.

Turn-Key, con't...

byte to non-zero, CP/M can be made to execute that program every time CP/M is loaded just as if the user had typed it.

Also notice the storage location of the scan pointer. Initially this location contains the address of the beginning of the command buffer (base + 8).

This technique was developed to allow my young daughter and her friends to select and run their choice of game from my collection of BASIC and machine language games without adult intervention.

This pointer is updated as CP/M scans the command buffer during processing. After processing the command, the pointer is again stored at this location for possible continuation. This will become important when the need to start processing from the beginning of the command buffer is desired. Use of this storage location will be demonstrated in the MENU program described later.

Modifying CP/M

The procedure to modify CP/M is straightforward and can be easily accomplished with either SID or DDT. DDT is normally provided with CP/M when purchased, so this program will be used to make the modifications. First, be sure that a spare diskette is available to receive the modified CP/M. Next, a copy of CP/M must be made so DDT can bring it into memory. This is accomplished using SYSGEN, a program that is also distributed with CP/M. Run the SYSGEN program as follows:

SYSGEN start the SYSGEN program
SYSGEN VERSION 1.4 SYSGEN sign on message
SOURCE DRIVE NAME (OR RETURN TO SKIP) A Type "A"
SOURCE ON A, THEN TYPE RETURN

At this point, be sure the diskette in drive A contains the CP/M to be used, then type a "RETURN." The program should respond with:

FUNCTION COMPLETE CP/M is now in memory
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)

The system will reboot at this point leaving a complete copy of CP/M in memory starting at 0980H and ending at 207FH. This copy of CP/M must be saved on the diskette. The save operation can be accomplished by typing:

SAVE 32CPM.COM Save 32 pages of memory

Now that a copy of CP/M exists as a disk file, DDT can load this file for modification by typing:

DDT CPM.COM Load DDT which loads CPM.COM

DDT should respond with:

NEXT PC
2100 0100

CP/M is now back in memory starting at 0980H. Using the "D" command, type D0980[cr]. The display should look like Figure 2. Notice the two JMP instructions, followed by a 7F, then the zero byte. The zero byte will be replaced by the length of the program name, although any non-zero byte will work. After this length byte, enter the name of the program that is to automatically get control. This must be a disk file of type ".COM" in order to be executable. In the example, the program name is "MENU.COM," so "MENU" is entered beginning at location 0988H. The easiest way to enter these modifications is with the "S" command of DDT. Type "S0987[cr]" and DDT will respond with:

0987 00 - DDT waits for user entry

"MENU" is four characters in length, so enter "04" at location 0987H. DDT will respond with the next address. Enter the hexadecimal value for the each letter of the command name followed by a "RETURN." Repeat the process until the complete name is entered. Finally, and this is very important, enter a "00" immediately after the program name. After completing these entries, exit the "S" command of DDT by typing ".[cr]" and then perform another "D0980[cr]." The data displayed should now appear as shown in Figure 3.

```
D0980
0980 C3 55 6C C3 51 6C 7F 04 4D 45 4E 55 00 20 20 20 .U1.Q1..MENU.
0990 20 20 20 20 20 20 20 20 43 4F 50 59 52 49 47 48         COPYRIGH
09A0 54 20 28 43 29 20 31 39 37 38 2C 20 44 49 47 49 T (C) 1978, DIGI
09B0 54 41 4C 20 52 45 53 45 41 52 43 48 20 20 00 00 TAL RESEARCH  ..
09C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
0A00 00 00 00 00 00 00 00 00 08 69 00 00 5F 0E 02 C3 .........i.._...
0A10 05 00 C5 CD 8C 69 C1 C9 3E 0D CD 8C 69 3E 0A C3 .....i..>...i>..
0A20 8C 69 C5 CD 98 69 E1 7E B7 C8 23 E5 CD 8C 69 E1 .i...i.~..#...i.
0A30 C3 A7 69 0E 0D C3 05 00 5F 0E 0E C3 05 00 0E 0F ..i....._.......
```

Figure 3

When the copy of CP/M in memory has been correctly modified as described, exit DDT by typing: "G0[cr]." Without doing any intervening operation which might destroy the memory image of the modified CP/M, save this copy by typing:

SAVE 32 AUTOCPM.COM save 32 pages of memory

Then, using SYSGEN again, construct a diskette with the new system as follows:

SYSGEN start the SYSGEN program
SYSGEN VERSION 1.4 SYSGEN sign on message
SOURCE DRIVE NAME (OR RETURN TO SKIP) type "RETURN"
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)A
DESTINATION ON A, THEN TYPE RETURN

Remove the diskette from drive A and insert the spare diskette which was previously prepared to receive the copy of the newly modified CP/M. When ready, type "RETURN." SYSGEN responds:

FUNCTION COMPLETE CP/M is now on diskette
DESTINATION DRIVE NAME (OR RETURN TO REBOOT)

Remove the new diskette and replace the original diskette. Type "RETURN" to reboot the system. The new diskette should be labeled and safely set aside until the MENU program has been prepared.

```
D0980
0980 C3 55 6C C3 51 6C 7F 00 20 20 20 20 20 20 20 20 .U1.Q1..
0990 20 20 20 20 20 20 20 20 43 4F 50 59 52 49 47 48         COPYRIGH
09A0 54 20 28 43 29 20 31 39 37 38 2C 20 44 49 47 49 T (C) 1978, DIGI
09B0 54 41 4C 20 52 45 53 45 41 52 43 48 20 20 00 00 TAL RESEARCH  ..
09C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09D0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
09F0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ................
0A00 00 00 00 00 00 00 00 00 08 69 00 00 5F 0E 02 C3 .........i.._...
0A10 05 00 C5 CD 8C 69 C1 C9 3E 0D CD 8C 69 3E 0A C3 .....i..>...i>..
0A20 8C 69 C5 CD 98 69 E1 7E B7 C8 23 E5 CD 8C 69 E1 .i...i.~..#...i.
0A30 C3 A7 69 0E 0D C3 05 00 5F 0E 0E C3 05 00 0E 0F ..i....._.......
```

Figure 2

Turn-Key, con't...

Menu Program In BASIC

At this point it should be pointed out that some versions of BASIC which operate under CP/M allow entering a command in the form:

A BASIC MENU.BAA

where BASIC is a disk file of type ".COM." Entering a command in this form causes CP/M to load and execute BASIC.COM, which in turn will load and execute MENU.BAA. (Note that the file type ".BAA" is optional in some versions - check your User's Manual.) CBASIC and a version of MICROSOFT BASIC distributed by TEI, Inc. are known to perform in this way. If the menu scheme is to be implemented in a BASIC of this type, or if it is desired to have a specific BASIC program begin execution immediately after power-up, this can be done by entering the entire command string, exactly as it would be typed, in the command buffer. Be sure to enter a non-zero character count in location 0987H. Most importantly, the command string **must** be followed by a 00. If the command string is so long as to overwrite the copyright notice, move the copyright notice to after the 00 byte following the command string. All the space up to and including 0A07H can be used, but be absolutely sure that no modifications occur above this location.

Conditional assembly was used to allow both machine language programs (.COM files) and BASIC programs to be "menu-ized."

For those readers who use BASIC exclusively, the only work remaining is to transfer BASIC.COM and the desired startup program to the diskette with the CP/M which has been modified for automatic execution. If, however, the use of machine language programs is desired, or the version of BASIC doesn't have the facilities to load programs under the control of another BASIC program, the MENU program to be described might be the solution. In my case, new games were frequently being added to the game diskette, and many of the games were written in machine language. This program was developed to allow menu-ization of either BASIC games or machine language programs.

Assembly-Language Menu

The menu program in Listing A is written in 8080 machine language and is fully compatible with the Z-80. A fully commented listing is provided. The program has six major parts: 1) search and sort; 2) assign menu numbers; 3) compute column offsets; 4) display the menu in four columns; 5) input the user's menu selection; and 6) load and execute the selected program.

The search and sort loop uses the built-in capability of CP/M to search the diskette directory for files which match a specified pattern name. The pattern is selected so only the desired "type" of files are found. This is done by using the "?" which forces any character in the corresponding position to be a match. For example, if all files of type ".BAS" are wanted, a pattern of "????????BAS" would be specified. The desired pattern is set up in what is called a "File Control Block" or FCB for short. The standard convention for "calling" CP/M routines is to put the memory address of the FCB in the [DE] register pair, and the command number in register [C]. A call is made to the standard CP/M entry point which is memory location 0005. CP/M returns the directory "address" in the accumulator. Since 64 file names are allowed, this address is simply the sequential position in the diskette directory (0-63). If no file name matches the specified pattern, a FFH is returned. The "Search First" command is used to find the first occurrence of a match, and the "Search Next" command is used to find all subsequent file names which match the pattern.

As each file name is found, the directory address is converted to a memory address. Since all disk reads are performed in 128 byte blocks starting at the default address of 0080H, four directory entries are loaded into memory. Thus, the file names will be 32 bytes apart and only the two least significant bits of the directory address are needed. The file name is then alphabetically compared to the previous file names and inserted into its proper place in the "Directory Table" (labeled DIR$TABLE in the listing).

The second major part of the program assigns the menu numbers to each file name in the Directory Table. Notice that space was allocated in the Table for the menu number. This arrangement greatly facilitates the display of the menu in column form. The CP/M "print buffer" command requires a "$" as a termination character, so this is also inserted in the directory table to make printing the table entries easier.

The third major part of the program figures out the column arrangement based on the number of files to be displayed. The files are listed alphabetically from top to bottom in four columns. The algorithm seems complicated, but was devised so that each column would have the same number of file names with the extras being added from left to right.

The fourth part of the program displays the Directory Table on the user's console using the offsets computed in part three. Extra line feeds are added to completely fill a 16 line video display terminal. This is easily changed to accommodate 24 line displays, or can be deleted as desired.

The fifth part of the program displays instructions to the user and waits for the menu number to be entered. Incorrect entries force a redisplay of the menu. This portion of the program makes use of still another CP/M capability - buffered input. The [DE] register pairs are setup to point to a section of memory to be used to receive the input text. The first byte of this memory must contain the maximum length of the buffer area, and the second byte will be set by CP/M to the actual count of characters entered.

The last part of the program converts the menu number entered by the user into the program name. The ASCII representation which was entered from the console keyboard is converted to binary. This is then converted to the memory address of the corresponding file name within the Directory Table. Once the correct file name is pointed, the proper command string is positioned in the CP/M command buffer. Notice how conditional assembly was used to allow both machine language programs (.COM files) and BASIC programs to be "menu-ized." In the first case, only the file name followed by a zero byte is placed in the command buffer. In the case of BASIC, the name of the BASIC as a .COM file is followed by the selected program name. Some

The instructions to the operator would be reduced to explaining how to turn on the computer, how to properly insert the diskette, and the procedure for pressing the RESET button.

Turn-Key, con't...

versions of BASIC, such as CBASIC, assume a file type, while other versions require that the file type be specified in the command line. The program allows either case to be handled.

After the menu number is converted to the correct address within the Directory Table, the location of the CP/M command buffer must be found. The buffer is known to start at the base + 7 (refer to Figure 1). The base is a known distance below the address stored at location 0006H. The base is needed since this is the entry point which will cause CP/M to process the command line which the program has constructed. So, by doing some simple arithmetic, the base of CP/M and the location of the command buffer can be found. The program does these calculations and the desired command string is properly positioned. There is one remaining problem which the program must solve. When first executed after initial load, CP/M detected the prepositioned command which was installed by the modification to CP/M. During the processing of this command, the scan pointer was moved to the end of this command and is no longer in the correct position to scan the new command line built by the program. Fortunately, the scan pointer is stored in a known location immediately after the end of the command buffer. Since the command buffer location is known, so is the storage location of the scan pointer. The program resets the scan pointer to the beginning of the command buffer and CP/M is ready to process the command.

Summary

This article has explained how to make CP/M execute a program upon power up by prepositioning the command in the command buffer. The requirement to reset the scan pointer to force CP/M to again process the command buffer was also explained. The producers of dedicated system software can take advantage of this capability and offer a system which is simpler to operate. The instructions to the operator would be reduced to explaining how to turn on the computer, how to properly insert the diskette, and the procedure for pressing the RESET button. Any additional instructions could be displayed by the program automatically executed. A true "turn-key" system? Perhaps not, but how much closer can you get without Read Only Memory? Happy Computing! □

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CIRCLE 156 ON READER SERVICE CARD

```
                        ;                       MENU PROGRAM
                        ;                           FOR
                        ;               MACHINE LANGUAGE OR BASIC PROGRAMS
                        ;
                        ;                           BY
                        ;                       JAMES J. FRANTZ
                        ;                       MAY 31, 1979
                        ;
                        ;THIS PROGRAM IS DESIGNED TO BE AUTOMATICALLY EXECUTED
                        ;BY CP/M IMMEDIATELY AFTER A COLD (OR WARM) BOOT. THIS
                        ;PROGRAM THEN DISPLAYS THE CONTENTS OF THE DISK IN A
                        ;MENU FASHION. ALL FILES OF SPECIFIED TYPE ARE SORTED AND
                        ;DISPLAYED ALPHABETICALLY IN FOUR COLUMNS. THE USER THEN
                        ;SELECTS THE DESIRED PROGRAM BY IT'S MENU NUMBER. THE
                        ;SELECTED PROGRAM IS THEN RUN.
                        ;
0100                            ORG     0100H
                        ;
                        ;
FFFF =                  BASIC$PROG      EQU     -1      ;SET TO 0 FOR MACHINE
                                                        ;LANGUAGE GAMES
                        ;
                        ;
                        ;FIRST THE CP/M 'SEARCH' COMMAND IS USED TO FIND THE
                        ;FIRST FILE OF THE SPECIFIED TYPE. THE POINTER TO THE FILE
                        ;CONTROL BLOCK IS PUT IN <DE>, AND THE COMMAND NUMBER IS
                        ;PUT IN <C>. THE FILE CONTROL BLOCK IS PRE-CONSTRUCTED TO
                        ;THE FORM '????????XXX0'. THE 'XXX' IS THE SPECIFIED FILE
                        ;'TYPE', AND THE '?' FORCE A MATCH TO ANY FILE NAME OF THAT
                        ;FILE TYPE.
                        ;
0100 31A706                     LXI     SP,STACK$AREA   ;SET UP A STACK
0103 0E11                       MVI     C,17            ;'SEARCH FIRST' COMMAND
                        ;
                        ;THIS NEXT ROUTINE SORTS THE FILE NAMES AS THEY ARE FOUND
                        ;ON THE DISK DIRECTORY. A NAME IS READ FROM THE DISK AND
                        ;ITS LOCATION IS FOUND IN THE DIRECTORY TABLE BY COMPARING
                        ;ALPHABETICALLY.
                        ;
                        SORT$LOOP:
0105 11FC02                     LXI     D,SRCH$FCB      ;POINT FILE CONTROL BLOCK
0108 CD0500                     CALL    BDOS            ;USE CP/M ENTRY POINT
                        ;
                        ;CP/M RETURNS THE DISK ADDRESS OF THE NEXT MATCH IN <A>.
                        ;THIS IS A VALUE BETWEEN 0 AND 64, OR -1 IF NO MATCH WAS
                        ;FOUND. TEST FOR -1 AND QUIT WHEN NO MORE FILES OF THE
                        ;SPECIFIED FILE 'TYPE' ARE FOUND ON THE DISK. THE DISK
                        ;ADDRESS IS CONVERTED TO A POINTER TO THE FILE NAME
                        ;WITHIN THE SECTOR BY MULTIPLYING BY 32 AND ADDING THE
                        ;BASE ADDRESS OF THE SECTOR.
                        ;
010B B7                         ORA     A               ;TEST FOR -1
010C FA6A01                     JM      ASSIGN$MENU$NBR ;PRINT EMPTY MENU
010F 0F                         RRC                     ;THIS IS THE SAME AS
0110 0F                         RRC                     ;5 "ADD A'S"
0111 0F                         RRC
0112 E660                       ANI     60H             ;MASK CORRECT BITS
0114 C680                       ADI     80H             ;ADD BASE ADDRESS(0080H)
0116 5F                         MOV     E,A             ;PUT POINTER IN <DE>
0117 1600                       MVI     D,0             ;AS 16 BIT VALUE
0119 210903                     LXI     H,DIRTABLE      ;POINT START OF TABLE OF
                                                        ;SORTED NAMES
011C 13                         INX     D               ;POINT PAST ERASE FIELD

                        COMPARE$LOOP:
011D D5                         PUSH    D               ;SAVE POINTER TO NEXT
                                                        ;ENTRY FROM DISK DIRECTORY
011E 0E08                       MVI     C,8             ;LENGTH OF COMPARE
0120 E5                         PUSH    H               ;SAVE POINTER TO TABLE
                        COMPARE1:
0121 1A                         LDAX    D               ;GET TRIAL NAME CHAR
0122 BE                         CMP     M               ;MATCH?
0123 C22C01                     JNZ     END$COMPARE     ;IF NOT, TRY NEXT ENTRY
0126 23                         INX     H               ;ADVANCE POINTERS
0127 13                         INX     D
0128 0D                         DCR     C               ;ONE LESS CHAR TO COMPARE
0129 C22101                     JNZ     COMPARE1        ;KEEP TESTING
                        END$COMPARE:
012C C1                         POP     B               ;RESTORE TABLE POINTER
012D DA3801                     JC      INSERT$NAME     ;DIRECTORY NAME GOES IN
                                                        ;FRONT OF CURRENT TABLE
                                                        ;ENTRY IF LOWER(CY=1)
0130 210E00                     LXI     H,14            ;LENGTH OF TABLE ENTRY
0133 09                         DAD     B               ;<HL> TO NEXT TABLE ENTRY
0134 D1                         POP     D               ;RECOVER TRIAL NAME POINT
0135 C31D01                     JMP     COMPARE$LOOP    ;LOOP AGAIN
                        ;
                        ;THIS NEXT PORTION MAKES ROOM IN THE DIRECTORY TABLE FOR
                        ;THE NEW ENTRY BY MOVING ALL ALPHABETICALLY HIGHER NAMES
                        ;UPWARD IN MEMO RY.
                        ;
                        INSERT$NAME:
0138 21F902                     LXI     H,FILE$COUNT    ;COUNT THE NUMBER OF FILES
013B 34                         INR     M               ;TO BE DISPLAYED
013C 2AF702                     LHLD    END$OF$TABLE    ;GET POINTER TO TABLE END
013F EB                         XCHG
0140 210E00                     LXI     H,14            ;DISTANCE TO MOVE
0143 19                         DAD     D               ;<HL> POINT DESTINATION
0144 22F702                     SHLD    END$OF$TABLE    ;SAVE THE NEW END OF TABLE
0147 23                         INX     H
0148 13                         INX     D
                        ;
                        MOVE$UP:
0149 1B                         DCX     D
014A 2B                         DCX     H
014B 1A                         LDAX    D               ;GET BYTE TO MOVE
014C 77                         MOV     M,A             ;PUT IN NEW SPOT
014D 79                         MOV     A,C             ;TEST FOR DONE
014E BB                         CMP     E               ;<BC> = <DE>?
014F C24901                     JNZ     MOVE$UP
0152 78                         MOV     A,B
0153 BA                         CMP     D
0154 C24901                     JNZ     MOVE$UP
0157 E1                         POP     H               ;RECOVER POINTER
0158 0E08                       MVI     C,8
015A CD7D02                     CALL    BLOCK$MOVE      ;INSERT NAME IN TABLE
                        ;
                        ;THE MENU NUMBER FIELD IS INSERTED IN THE DIRECTORY TABLE
                        ;AT THIS POINT BUT THE ACTUAL MENU NUMBER WILL BE ASSIGNED
                        ;AFTER ALL FILES ARE SORTED.
                        ;
015D 21ED02                     LXI     H,MENU$BUFF     ;POINT MENU NUMBER BLOCK
0160 0E06                       MVI     C,6             ;LENGTH OF MOVE
0162 CD7D02                     CALL    BLOCK$MOVE      ;INSERT TEXT IN TABLE
                        ;
                        ;THE COMMAND NUMBER FOR SUBSEQUENT SEARCHES OF THE DISK
                        ;DIRECTORY MUST BE ALTERED TO CAUSE CP/M TO SEARCH FROM
```

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sargon II

by Dan and Kathe Spraklen from Hayden

The best of the micro chess playing programs that came in third in the 9th North American Computer Chess Championship! Personal Computing magazine said "Buy this program when it becomes available . . . unequaled in the end game . . ." $29.95.

mean checker machine

by Lance Miklus from TSE

A quick and brillant checker playing program. Four levels of play are in this machine language program. $19.95.

gammon challenger

by Ray Daly and Tom Throop from Acorn

This backgammon player has three levels of play and many special features. A game in which it gammoned the Tryom's Gammonmaster was featured in the August issue of Personal Computing.

go moko

by Phil Pilgrim from Discovery Bay

Program plays you in the ancient Japanesse game of five-in-a-row. Play on a 9 by 9 grid. $14.95.

code breaker

by Mikal Pedersen from Acorn

Puzzling, challenging, exciting. A different game of determining the colors of four secret code pegs. Includes sound effects. $9.95.

poker pete

by David Gubser from Quality

Play five card draw poker against animated Pete. He shuffles and deals. Pete will bluff, raise, call or fold. Watch out - Pete's got a gun! $9.95.

win 21

by Phil Pilgrim from Discovery Bay

Don't gamble, learn to play expert blackjack. Includes book Beat The Dealer and comprehensive instructions. $29.95.

bridge challenger

by George Duisman from Personal

You play your hand and the dummy against the Challenger in 4 person Contract Bridge. Hands dealt at random or according to your criterion for high card points. You can review tricks, swap sides or replay hands when the cards are known. An always willing opponent. $14.95.

LIBRARY 100

from bottom shelf

One hundred programs on 5 cassettes plus the programming language Tiny Pilot! 25 business and finance, 15 graphic, 15 home, 15 educational and 30 games. $49.95.

NEWDOS+

from Apparat

This disk operating system is quickly becoming the standard. Not only are fixes made to the Radio Shack TRSDOS, but several utilities are added, including LEVEL1, EDTASM, DIRCHECK, and SUPERZAP. $99.95.

"TRS-80 DISK"

by H.C. Pennington

We don't usually list books, but this one is so unique that we thought you would want to know about it. There are over 100 pages about how DOS works, how a disk is organized, and how to recover from errors. This is THE technical backup for NEWDOS with great illustrations. $19.95.

TUTIL & DUTIL

by Roy Soltoff from Misosys and Acorn

The Tape Utility (Tutil) and the Disk Utility (Dutil) provide you with a powerful software aid in debugging machine language programs, in using the Radio Shack Editor/Assembler, and in performing various utility functions. Examine, clear, initialize, move, compare and modify memory data plus search memory for up to 24-character strings; punch, load, verify, run machine language programs and display file names; display and modify registers in English; add and subtract in hex; jump and set breakpoints; and interface to E/A. Output to video and printer simultaneously. Includes E/A modify program.

The Disk Utility includes these features and more. Read and write disk sectors, even to the directory track; track read, sector scroll and disk save or restore of E/A test buffer.

Tutil $14.95 Dutil $19.95

COMPROC

by Johnston and Johnston from Racet Computes

Your programs can execute automatically at DOS boot. Turn on the system and be up and running. You can execute any series of DOS commands and even answer responses in a BASIC program. It makes the computer easier to use for the non-programmer. Well documented. $19.95.

BASIC-1P

from Small System Software

This program provides full Level I BASIC capability in any Level II, 16k TRS-80. Plus it adds the printing commands of LPRINT and LLIST so you can now list your programs and control your printer from Level I BASIC. Two new commands, LPRINT ON and LPRINT OFF allow you to print anything that is displayed on the screen. Using only 4k of RAM, you have 12k for your Level I programs. Any Level I BASIC program or data tape may be used without conversion. All commands and abbreviations are supported. $19.95.

INFINITE BASIC

by Johnston and Johnston from Racet Computes

Add 50 different string functions and 30 array and matrix functions to your Level II or DOS BASIC. $49.95.

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Arcade video games are always fun to play. Acorn Software Products recently released versions of four popular arcade games. Alien Invasion, Block'em, and Ting-Tong all have sound effects. You'll be hearing a lot more about Acorn.

alien invasion

by Roy Niederhoffer from Acorn

The arcade game that you've been looking for. You shoot your laser gun at the invaders while avoiding their bombs. Game includes sound effects and graphics. Watch out for asteroids and black holes. $9.95.

block'em

by Joseph Moran from Acorn

Maneuver your blockade so that your opponent crashes before you do. You get four different game options, nine speeds, and sound effects. For two players, in machine language and only 4k needed. $9.95.

space war

by Device Oriented Games from Acorn

Two-player, real-time space battle lets each player control a space ship with rotate, thrust, fire, and hyperspace. Five game options (including gravity) and three speeds are included. In machine language. $9.95.

ting-tong

by Ray Daly from Acorn

Ping-pong for the TRS-80. The game is for one or two players with eight speeds and includes sound effects. In machine language. Only 4k needed. $9.95.

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                        ;WHERE IT LEFT OFF.
                        ;
0165 0E12               MVI     C,18            ;'SEARCH NEXT' COMMAND
0167 C30501             JMP     SORT$LOOP
                        ;
                        ;
                        ;THIS IS THE SECOND MAJOR PORTION OF THE PROGRAM. AT THIS
                        ;POINT ALL FILES HAVE BEEN INSERTED IN THE DIRECTORY TABLE
                        ;IN ALPHABETICAL ORDER. NOW THE MENU NUMBERS ARE ASSIGNED
                        ;AND INSERTED IN THE PROPER PLACE IN PREPARATION FOR
                        ;DISPLAY ON THE TERMINAL.
                        ;
                        ASSIGN$MENU$NBR:
016A 3AF902             LDA     FILE$COUNT
016D 47                 MOV     B,A             ;SAVE IN <B>
016E F5                 PUSH    PSW             ;AND ON STACK
016F 0E00               MVI     C,0             ;INITIAL FILE NUMBER
0171 211403             LXI     H,DIRTABLE+11   ;POINT FIRST FILE NUMBER
0174 110D00             LXI     D,13            ;OFFSET TO OTHER NUMBERS
                        NUMBER$FILES:
0177 79                 MOV     A,C             ;PUT FILE NUMBER IN <A>
0178 C601               ADI     1               ;INCREMENT
017A 27                 DAA                     ;DECIMAL CONVERT
017B 4F                 MOV     C,A             ;RESAVE IN <C>
017C 0F                 RRC                     ;GET TENS DIGIT INTO
017D 0F                 RRC                     ;PROPER PLACE
017E 0F                 RRC
017F 0F                 RRC
0180 E60F               ANI     0FH             ;AND MASK
0182 CA8701             JZ      USE$BLANK       ;SUPPRESS LEADING ZERO BY
0185 C610               ADI     10H             ;ADD EITHER 20H(ASCII ' ')
                        USE$BLANK:
0187 C620               ADI     ' '             ;OR 20H + 10H FOR NUMERAL
0189 77                 MOV     M,A             ;PUT IN TEXT STREAM
018A 79                 MOV     A,C             ;GET UNITS PORTION
018B E60F               ANI     0FH             ;MASK OFF TENS PORTION
018D C630               ADI     '0'             ;CONVERT TO ASCII
018F 23                 INX     H
0190 77                 MOV     M,A
0191 19                 DAD     D               ;REPEAT UNTIL ALL FILES
0192 05                 DCR     B               ;ARE SEQUENTIALLY NUMBERED
0193 C27701             JNZ     NUMBER$FILES
                        ;
0196 F1                 POP     PSW             ;GET FILE$COUNT FROM STACK
0197 F5                 PUSH    PSW             ;AND SAVE AGAIN FOR LATER
                        ;
                        ;THIS ALGORYTHM ENSURES THE COLUMNS ARE AS EVEN IN LENGTH
                        ;AS POSSIBLE. DON'T WORRY, IT WORKS.
                        ;
0198 C603               ADI     NBR$COL - 1
019A 06FF               MVI     B,-1            ;<B> ACCUMULATES QUOTIENT
                                                ;SO SET TO -1 FOR AT LEAST
                                                ;1 PASS THRU GIVES 0
019C 04                 DIVX    INR     B
019D D604               SUI     NBR$COL         ;DIVIDE (FILE$COUNT+3) BY
                                                ;FOUR TO GET OFFSET1
019F F29C01             JP      DIVX
01A2 C604               ADI     NBR$COL         ;SUBTRACTED ONCE TOO MUCH
                                                ;SO ADD IT BACK ON
01A4 21F402             LXI     H,OFFSET1
01A7 70                 MOV     M,B             ;INSERT OFFSET1 INTO TABLE
01A8 23                 INX     H               ;POINT OFFSET2 LOCATION
01A9 C2AD01             JNZ     SETOFFSET2      ;SAME AS OFFSET1 IF NON-
01AC 05                                         ;ZERO REMAINDER
                        DCR     B               ;ELSE OFFSET2=OFFSET1-1
                        SETOFFSET2:
01AD 70                 MOV     M,B             ;PUT OFFSET2 IN TABLE
01AE 23                 INX     H               ;POINT OFFSET FOR COL 3
01AF 3D                 DCR     A               ;TEST FOR REMAINER OF 1
01B0 C2B401             JNZ     SETOFFSET3      ;IF REMAINDER <> 1, USE
                                                ;OFFSET3=OFFSET2
01B3 05                 DCR     B               ;ELSE OFFSET3=OFFSET2-1
                        SETOFFSET3:
01B4 70                 MOV     M,B             ;OFFSET TO COLUMN 4
                        ;
                        ;NOW THAT THE OFFSETS FOR THE COLUMNS HAVE BEEN DETERMINED
                        ;THE ACTUAL PRINT OUT CAN BE MADE.
                        ;
                        REPRINT:
01B5 F1                 POP     PSW             ;RECOVER FILE COUNT
                        REPRINT1:
01B6 F5                 PUSH    PSW             ;SAVE AGAIN FOR LATER USE
01B7 32F902             STA     FILE$COUNT      ;SAVE FOR COUNTING
01BA 3E0C               MVI     A,SCREEN$HGT    ;SET FOR VIDEO DISPLAY SIZE
01BC 32FB02             STA     LINE$COUNT
01BF 11A802             LXI     D,HEADING
01C2 0E09               MVI     C,9             ;BUFFER PRINT COMMAND
01C4 CD0500             CALL    BDOS            ;CP/M PRINTS HEADING
                        ;
01C7 21FB02             LXI     H,DIR$TABLE - 14 ;POINT DUMMY 0TH ENTRY
                        ;
                        PRINT$LINE:
01CA E5                 PUSH    H               ;SAVE BASE ADDRESS
01CB 11F302             LXI     D,OFFSET0       ;POINT OFFSET TABLE
01CE 3E04               MVI     A,NBR$COL       ;4 COLUMNS PER LINE
                        PRINT$NAME:
01D0 32FA02             STA     COLUMN$CNT      ;SAVE COUNT OF COLUMNS
01D3 E5                 PUSH    H               ;SAVE CURRENT NAME POINTER
01D4 D5                 PUSH    D               ;SAVE OFFSET TABLE POINTER
                        ;
01D5 11EA02             LXI     D,DOUBL$SPACE   ;PRINT 2 BLANKS
01D8 0E09               MVI     C,9             ;'PRINT BUFFER' COMMAND
01DA CD0500             CALL    BDOS            ;USE CP/M FACILITY
01DD D1                 POP     D               ;GET OFFSET TABLE POINTER
01DE E1                 POP     H               ;GET NAME POINTER
01DF 1A                 LDAX    D               ;GET OFFSET VALUE
                        ;
                        ;THE OFFSET VALUE IS THE NUMBER OF FILE NAMES FROM THE
                        ;CURRENT NAME POINTER TO MOVE THE PRINT POINTER.
                        ;
01E0 010E00             LXI     B,14            ;EACH NAME IS 14 LONG
                        MULT$14:
01E3 09                 DAD     B               ;ADD 14 FOR EACH OFFSET
01E4 3D                 DCR     A               ;UNTIL OFFSET = 0
01E5 C2E301             JNZ     MULT$14
01E8 E5                 PUSH    H               ;SAVE NEW NAME POINTER
01E9 D5                 PUSH    D               ;SAVE OFFSET POINTER
01EA EB                 XCHG                    ;POINT NAME TO PRINT W/<DE>
01EB 0E09               MVI     C,9             ;PRINT BUFFER
01ED CD0500             CALL    BDOS            ;PRINT THE FILE NAME AND
                                                ;ITS MENU NUMBER
                        ;
                        TEST$FINISH:
01F0 21F902             LXI     H,FILE$COUNT    ;SEE IF DONE PRINTING
01F3 35                 DCR     M               ;BY TESTING COUNT OF FILES
01F4 D1                 POP     D               ;GET OFFSET POINTER
01F5 E1                 POP     H               ;GET POINTER TO LAST NAME
```

GIVE YOUR TRS-80 A LITTLE CHRISTMAS PACKAGE. (YOU'VE EARNED IT!)

Graphic Drawing Done On The TRS80 Using "The Electric Artist" Program!

GRAPHIC-TREK "2000" This full graphics, real time game is full of fast, exciting action! Exploding photon torpedoes and phasers fill the screen! You must actually navigate the enterprize to dock with the giant space stations as well as to avoid klingon torpedoes! Has shields, galactic memory readout, damage reports, long range sensors, etc! Has 3 levels for beginning, average, or expert players!

INVASION WORG Time: 2099 Place: Earth's Solar System Mission: As general of earths forces, your job is to stop the Worg invasion and destroy their outposts on mars, venus, saturn, neptune, etc! Earth's Forces: Androids — Space Fighters — Lazer Cannon — Nuetrino Blasters! Worg Forces: Robots — Saucers — Disintegraters — Proton Destroyers! Multi level game lets you advance to more complicated game as you get better!

STAR WARS Manuever your space fighter deep into the nucleus of the Death Star! Drop your bomb then escape via the only escape route. This graphics game is really fun! May the force be with you!

SPACE TARGET Shoot at enemy ships with your lazer gun. If they eject in a lifeboat vehicle, capture them, or if your cruel, destroy them! Full graphics, real time game!

SAUCERS This fast action graphics game, has a time limit! Can you be the commander to win the distinguished cross! Requires split second timing to win! Watch out! The saucers fight back!

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CHECKERS 2.1 Finally! A checkers program that will challenge everyone! Expert as well as amateur! Uses 3-ply tree search to find best possible move. Picks randomly between equal moves to assure you of never having identical games. Computer also makes sly remarks about the game!

POKER FACE The computer uses psychology as well as logic to try and beat you at poker. Cards are displayed using TRS-80's full graphics. Computer raises, calls, and sometimes even folds! Great practice for your Saturday night poker match!

PSYCHIC Tell the computer a little about yourself and he'll predict things about you, you won't believe! A real mind bender! Great amusement for party's.

TANGLE MANIA Try and force your opponent into an immobile position. But watch out, their doing the same to you! This graphics game is for 2 people and has been used to end stupid arguments. (And occasionally starts them!)

WORD SCRAMBLE This game is for two or more people. One person inputs a word to the computer while the others look away. The computer scrambles word then keeps track of wrong guesses. Can you make less mistakes then your adversary?

Package Two — $12.95

POETRY This exciting and sometimes funny program lets you choose the subject as well as the mood of the poem you want. You give TRS-80 certain nouns or names, then mood, and he does the rest! TRS-80 will write different poetry about one subject forever if you let him. Has a 1000 word + vocabulary of nouns, verbs, adjectives, adverbs!

ELECTRIC ARTIST Written by a working artist and a computer engineer to make drawing on the video screen easier then picking up a pencil! (Less messy too!) Manual: Draw, erase, move as well as, Auto: Draw, erase, move. Uses graphics bit's not bytes. Graphic face in ad done using this ingenius program!

GALACTIC BATTLE The Swineus enemy have long range phasers but cannot travel at warp speed! You can, but only have short range phasers! Can you blitzkrieg the enemy without getting destroyed! Full graphics — real time!

WORD MANIA Can you guess the computers words using your human intuitive and logical abilities? You'll need to, to beat the computer! He keeps score and gets mad if he loses!

AIR COMMAND Real time, graphics Flight Simulater! Land, take-off, get out of a spin! Be careful not to stall! Watch your fuel gauge! Requires a clear headed pilot.

Package Three — $12.95

LIFE This Z-80 machine language program uses full graphics! Over 100 generations per minute make it truly animated! You make your starting pattern, computer does the rest! Program can be stopped and changes made! Watch it grow!

REAL TIME LANDER This full graphics simulater lets you pick what planet, asteroid or moon you wish to land on! The "Live" keyboard gives super response that gives you the feeling of being in command! Has 3 skill levels that make it fun for everyone.

GREED II Multi-level game is fun and challenging! Beat the computer at this dice game using your knowledge of odds and luck! Computer keeps track of his winnings and yours. Quick fast action. This game is not easy!

THE PHARAOH Rule the ancient city of Alexandra! Buy or sell land. Keep your people from revolting! Stop the rampaging rats and locusts'. Requires a true political personality to become good!

ROBOT HUNTER A group of renegade robots have escaped and are spotted in an old ghosttown on mars! Your job as "Robot Hunter" is to destroy the pirate machines before they kill any more settlers! Exciting! Challenging! Full graphics!

Package Four — $12.95

SUPER HORSERACE! Make your bets just like at the real racetrack! 8 horses race in this spectacular graphic display! Up to 9 people can play! Use's real odds but has that element of chance you see in real life! Keeps track of everyone's winnings and losings. This is one of the few computer simulations that can actually get a room of people cheering!

MAZE MOUSE The mouse with a mind! Computer generates random mazes of whatever size you specify then searches for way out! The second time thru he'll always go fastest route! A true display of artificial intelligence! Full graphics, mazes & mouse!

AMOEBA KILLER You command a one man submarine that has been shrunken to the size of bacteria in this exciting graphic adventure! Injected into the presidents bloodstream, your mission is to destroy the deadly amoeba infection rampaging his body!

LOGIC This popular game is based on mastermind but utilizes tactics that make it more exciting and challenging! Has 2 levels of play to make it fun for everyone.

SUBMARINER Shoot torpedoes at the enemy ships to get points. Fast action graphics, arcade type game is exciting and fun for everybody!

Package Five — $12.95

20 HOME FINANCIAL PROGRAMS Did you ever get a loan and wonder if they figured interest or payments correctly? Or did you ever want to see what your payments would be if you borrowed x amount at x% interest over x years! Figures amortization, anuitys, depreciation rates, interest tables, earned interest on savings and much, much more. This program will get used again and again. A must for the conscientious, inflation minded person.

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01F6 CA0C02          JZ      FINISH          ;NO MORE TO PRINT.
01F9 13              INX     D               ;ADVANCE OFFSET POINTER
01FA 3AFA02          LDA     COLUMN$CNT
01FD 3D              DCR     A               ;SEE IF COLUMNS LEFT = 0
01FE C2D001          JNZ     PRINT$NAME      ;PRINT ANOTHER SAME LINE.
0201 CD9802          CALL    CRLF            ;MOVE TO NEXT LINE
0204 E1              POP     H               ;GET BASE OF PREVIOUS LINE
0205 110E00          LXI     D,14            ;ADD OFFSET
0208 19              DAD     D
0209 C3CA01          JMP     PRINT$LINE
                     ;
                     ;THE FILE NAMES AND THEIR MENU NUMBERS HAVE BEEN PRINTED.
                     ;THIS NEXT [illegible]OP OUTPUTS SUFFICIENT LINE FEEDS TO PUT THE
                     ;HEADING [illegible]E TOP OF A 16 LINE VIDEO DISPLAY(THEREBY
                     ;CLEARING [illegible] SCREEN), AND PUTS THE REQUEST FOR USER
                     ;SELECTION AT THE BOTTOM OF THE SCREEN.
                     ;
                     ;
                     FINISH:
020C E1              POP     H               ;UNJUNK STACK
                     LF$LOOP:
020D CD9802          CALL    CRLF
0210 F20D02          JP      LF$LOOP         ;OMIT THIS LINE IF DESIRED
0213 11C402          LXI     D,PROMPT        ;POINT INSTRUCTION MSG.
0216 0E09            MVI     C,9
0218 CD0500          CALL    BDOS            ;AGAIN CP/M PRINTS MESSAGE
021B 11A706          LXI     D,INPUT$BUFF
021E 3E0A            MVI     A,10            ;TEN CHARACTERS MAX
0220 12              STAX    D
0221 0E0A            MVI     C,10            ;'READ BUFFER' COMMAND
0223 CD0500          CALL    BDOS
                     ;
                     ;ON RETURN FROM BDOS LINE INPUT FUNCTION, THE DIGITS
                     ;TYPED BY THE USER ARE IN THE BUFFER AT INPUT$BUFF+2.
                     ;CONVERT TO BINARY.
                     ;
0226 21A806          LXI     H,INPUT$BUFF+1  ;POINT CHAR COUNT
0229 7E              MOV     A,M             ;GET IT AND SEE IF > 2
022A FE03            CPI     3
022C D2B501          JNC     REPRINT         ;REPRINT THE MENU
022F 4F              MOV     C,A             ;COUNT OF DIGITS TO <C>
0230 0600            MVI     B,0             ;ZERO <B>
                     ;
                     GET$MENU$NBR:
0232 23              INX     H               ;POINT ASCII DIGIT
0233 7E              MOV     A,M             ;GET IT
0234 CD8602          CALL    ASCII$CONVERT   ;CONVERT TO BINARY
0237 DAB501          JC      REPRINT         ;RE-DISPLAY ON ERROR
023A 0D              DCR     C
023B C23202          JNZ     GET$MENU$NBR
                     ;
                     ;<B> HAS THE MENU NUMBER. TO BE SURE THIS IS A LEGAL MENU
                     ;REQUEST, COMPARE WITH FILE$COUNT (STILL ON STACK).
                     ;
023E F1              POP     PSW             ;RECOVER FILE COUNT
023F B8              CMP     B               ;FILE$COUNT-REQUEST NBR.
0240 DAB601          JC      REPRINT1        ;RE-DISPLAY MENU IF ILLEGAL.
                     ;
                     ;
0243 110E00          LXI     D,14            ;INCREMENT BETWEEN NAMES
0246 21FB02          LXI     H,DIR$TABLE - 14 ;POINT DUMMY 0TH ENTRY
                     FIND$NAME:
0249 19              DAD     D               ;ADD OFFSET <B> TIMES
024A 05              DCR     B

024B C24902          JNZ     FIND$NAME
                     ;
                     ;AT THIS POINT <HL> POINTS THE SELECTED FILE NAME. NOW FIND
                     ;THE ADDRESS OF CP/M SO THE PROPER COMMAND NAME AND THE
                     ;SELECTED FILE NAME CAN BE PUT INTO THE COMMAND BUFFER.
                     ;
024E EB              XCHG                    ;SAVE POINTER TO FILE NAME
024F 2A0600          LHLD    6               ;GET BDOS ENTRY POINT
0252 01FAF7          LXI     B,- CCP$LEN     ;OFFSET TO START OF CP/M
0255 09              DAD     B
0256 E5              PUSH    H               ;SAVE CP/M ENTRY POINT
                                             ;ON STACK FOR BRANCH.
0257 010800          LXI     B,8             ;OFFSET TO COMMAND BUFFER
025A 09              DAD     B               ;<HL> POINTS PLACE TO PUT
                                             ;NAME OF .COM FILE TO BE
                                             ;EXECUTED.
025B D5              PUSH    D               ;SAVE POINTER TO FILE NAME
025C EB              XCHG                    ;<DE> POINTS COMMAND BUFF
                     ;
                     ;SINCE THE SCAN POINTER IS NOT RESET BY REENTRY INTO CP/M
                     ;THE SCAN POINTER MUST BE RESET BY THIS PROGRAM. THE SCAN
                     ;POINTER IS STORED BY CP/M AT THE END OF THE COMMAND
                     ;BUFFER.
                     ;
025D 218000          LXI     H,128           ;OFFSET TO END OF CMD BUFF
                                             ;WHERE POINTER IS STORED
0260 19              DAD     D               ;<HL> POINTS STORAGE PLACE
0261 73              MOV     M,E             ;UPDATE BUFFER POINTER TO
0262 23              INX     H               ;THE START OF THE COMMAND
0263 72              MOV     M,D             ;BUFF SO CP/M WILL READ.
                     ;
                             IF      BASIC$PROG      ;CONDITIONAL ASSEMBLY
                                                     ;FOR BASIC TO RUN THE
                                                     ;SELECTED PROGRAM
0264 21BA02          LXI     H,COMMAND$NAME  ;POINT COMMAND NAME
0267 0E06            MVI     C,LEN$CMD$NAME  ;LENGTH OF COMMAND NAME
0269 CD7D02          CALL    BLOCK$MOVE
                     ;
                             ENDIF
                     ;
                     ;
026C E1              POP     H               ;POINT SELECTED FILE NAME
026D 0E08            MVI     C,8             ;LENGTH OF FILE NAME
026F CD7D02          CALL    BLOCK$MOVE
                     ;
                     ;*****************************************************
                     ;IF THE VERSION OF BASIC TO BE USED DOES NOT REQUIRE THE
                     ;FILE TYPE TO BE SPECIFIED IN THE COMMAND LINE, OMIT THE
                     ;LINES BETWEEN THE ASTERICK LINES.
                     ;
                             IF      BASIC$PROG      ;AGAIN FOR SOME VERSIONS
                                                     ;OF BASIC WHICH REQUIRE
                                                     ;THE FILE TYPE TO BE
                                                     ;SPECIFIED.
0272 21C002          LXI     H,SPEC$TYPE     ;NEEDED BY SOME VERSIONS
                                             ;OF BASIC
0275 0E04            MVI     C,4             ;LENGTH OF 'TYPE' FIELD
0277 CD7D02          CALL    BLOCK$MOVE
                     ;
                             ENDIF
                     ;
                     ;*****************************************************
                     ;
```

SMALL SOFTWARE SYSTEM TRS-80 PRODUCTS SMALL SOFTWARE SYSTEM

MACHINE LANGUAGE GAMES

AIR RAID, BARRICADE or **RSL-1: - $10.00** each, all 3 for **$25.00**

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MODEL-II TRS-80

Small System Software is currently developing several programs for the Model II TRS-80. An enhanced RSM monitor with many new features will be available about January. We are adapting CP/M (tm Digital Reaserch, Inc.) in conjunction with Lifeboat Associates. CP/M for the Model II will be a "standard" version and will run all existing CP/M software, including Cobol, Fortran, C-Basic, M-Basic, business and accounting packages, etc. Write for details!

PROFESSIONAL SOFTWARE

MICROSOFT SOFTWARE PACKAGES - $80.00 each, **$150.00** for both

ASSEMBLER PACKAGE: Macro Assembler uses Zilog mnemonics and produces relocatable code! Includes Linking Loader, Editor and Cross Reference Utilities. Requires 32K and 1 disk drive.

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Write text, delete, insert, or move words, lines or paragraphs, save text on tape (or disk), then print formatted copy with our TRS232 or Centronics printer (RS-232-C with disk version). Right justification, page titling and numbering, transparent cursor and repeating keyboard. Upper case only, or lowercase with modification. Level-1 or 2 16K (tape version).

CP/M OPERATING SYSTEM WITH TRS232 SOFTWARE - $145.00

SMALL SYSTEM SOFTWARE/LIFEBOAT ASSOCIATES version of CP/M. Includes TRS232 and RS-232-C software, lower-case support, debounce, DCV-2 and other unique utilities. CP/M Editor creates and modifies all files. Assemble from disk, placing HEX and PRINT files back onto disk! Includes DDT (Dynamic Debugging Tool), PIP (Peripheral Interchange Program), and more! CP/M is a trademark of Digital Reasearch, Inc.

PRINTER SUPPORT

TRS232 PRINTER INTERFACE - $49.95 (+$2.00 shipping)

Assembled and tested output port for TRS-80 printing. Use Diablo, Teletype, TI Silent or any RS-232 or 20-mil current loop ASCII printer. Expansion interface not required. Use with LEVEL-II BASIC, CP/M, BASIC-1P, ELECTRIC PENCIL, RSM-2/2D or your own programs! Standard cassette software included, or order new "FORMATTER" (below) for enhanced printer control.

TRS232 "FORMATTER" SOFTWARE PACKAGE - $14.95

Enhanced software for with Level-2 Basic and our TRS232. Page and line length control, form feed function, printer pause, "smart" line termination, indented continuation lines, keyboard debounce, echo screen to printer, etc. Includes BASIC cassette and BASIC and machine language source listings.

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Many programs do not include provisions for printing with either our TRS232 or the Radio Shack RS-232-C. We currently offer the following tapes for adding printing functions:

RSM RS-232-C: Adds RS-232-C capability to RSM-2/2D
PENCIL RS-232-C: For cassette version of Electric Pencil
EDTASM PRINT: TRS232 and RS-232-C for disk/tape EDTASM

OTHER TRS-80 PRODUCTS

ESP-1: $29.95 Assembler, Editor & Monitor (8080 mnemonics)
LST-1: 8.00 Listing of Level-1 BASIC with some comments

SMALL SYSTEM SOFTWARE P.O. BOX 366 **NEWBURY PARK, CA 91320**

CIRCLE 194 ON READER SERVICE CARD

```
                        ;
027A AF                 XRA     A               ;NEED A ZERO AT END
027B 12                 STAX    D               ;OF COMMAND LINE
                        ;
                        ;THE ADDRESS OF CP/M IS ON THE STACK SO A SIMPLE RETURN
                        ;WILL EXECUTE CP/M AND IN TURN EXECUTE `BASIC [FILENAME]'.
                        ;
027C C9                 RET
                        ;
                        ;SUBROUTINES:
                        ;
                        BLOCK$MOVE:
027D 7E                 MOV     A,M
027E 12                 STAX    D
027F 13                 INX     D
0280 23                 INX     H
0281 0D                 DCR     C
0282 C27D02             JNZ     BLOCK$MOVE
0285 C9                 RET
                        ;
                        ASCII$CONVERT:
0286 D630               SUI     '0'             ;SUBTRACT ASCII BIAS
0288 FE0A               CPI     9 + 1           ;BE SURE IT'S NUMERIC
028A 3F                 CMC
028B D8                 RC                      ;SET CY=1 IF ILLEGAL
028C 57                 MOV     D,A             ;SAVE IN <D>
028D 78                 MOV     A,B             ;GET PREVIOUS RESULT
028E 07                 RLC                     ;MULTIPLY BY 2
028F 07                 RLC                     ;THEN 4
0290 07                 RLC                     ;THEN 8
0291 80                 ADD     B               ;THEN 9
0292 D8                 RC                      ;OUT OF BOUNDS
0293 80                 ADD     B               ;THEN FINALLY 8Y 10
0294 D8                 RC                      ;CY=1 ALWAYS MEANS ERROR
0295 82                 ADD     D               ;ADD IN NEW RESULT
0296 47                 MOV     B,A             ;SAVE IN <B>
0297 C9                 RET
                        ;
                        CRLF:
0298 11A502             LXI     D,CRLFMSG
029B 0E09               MVI     C,9             ;BUFFER PRINT
029D CD0500             CALL    BDOS
02A0 21FB02             LXI     H,LINE$COUNT
02A3 35                 DCR     M
02A4 C9                 RET
                        ;
02A5 0D0A24     CRLFMSG DB      0DH,0AH,'$'
                        ;
02A8 0A0909092HEADING DB        0AH,9,9,9,'      MENU',0DH,0AH,0AH,'$'
                        ;
                        IF      BASIC$PROG      ;CONDITIONAL ASSEMBLY FOR
                                                ;BASIC.COM + FILENAME
                        ;
                        COMMAND$NAME:
02BA 4241534943         DB      'BASIC '        ;INSERT THE NAME OF THE
                                                ;BASIC TO BE USED (E.G:
                                                ;`CRUN', `CRUN2', ETC.)
                        ;
0006 =                  LEN$CMD$NAME    EQU     $-COMMAND$NAME
                        ;
                        SPEC$TYPE:
02C0 2E424141           DB      '.BAA'          ;ONLY IF REQUIRED BY BASIC
                                                ;VERSION USED.
                        ;
                        ENDIF
                        ;
                        PROMPT:
02C4 454E544552         DB      'ENTER MENU NUMBER AND PRESS `RETURN'' $'
                        ;
                        DOUBL$SPACE:
02EA 202024             DB      '  $'
                        ;
                        MENU$BUFF:
02ED 202D202030         DB      ' -  0$'
                        ;
                        ;
02F3 01                 OFFSET0 DB      1
02F4 000A00             OFFSET1 DB      0,0,0
                        ;
                        END$OF$TABLE:
02F7 0903               DW      DIRTABLE
                        ;
                        FILE$COUNT:
02F9 00                 DB      0
                        COLUMN$CNT:
02FA 04                 DB      4
                        LINE$COUNT:
02FB 00                 DB      0
                        ;
                        ;IN THE NEXT LINE INSERT THE FILE TYPE OF THE FILES TO BE
                        ;DISPLAYED.
                        ;
                        IF      BASIC$PROG
                        ;
                        SRCH$FCB:
02FC 003F3F3F3F         DB      0,'????????BAA',0
                        ;
                        ELSE                    ;FOR MACHINE LANGUAGE
                        ;
                        SRCH$FCB:
                        DB      0,'????????COM',0       ;FOR MACHINE
                                                        ;LANGUAGE GAMES
                        ;
                        ENDIF
                        ;
                        ;
                        DIR$TABLE:
0309 FF                 DB      -1              ;FORCE FIRST FILE
                                                ;TO BE PUT HERE
                        ;
06A7 =                  STACK$AREA EQU  DIR$TABLE + 64*14 + 30
                        ;
06A7 =                  INPUT$BUFF EQU  STACK$AREA
                        ;
                        ;EQUATES:
                        ;
0005 =                  BDOS    EQU     5
0004 =                  NBR$COL EQU     4
0806 =                  CCP$LEN EQU     3106H-2900H
0010 =                  SCREEN$SIZE EQU 16              ;CHANGE AS APPROPRIATE
                                                        ;FOR VIDEO
000C =                  SCREEN$HGT  EQU SCREEN$SIZE - 4
                        ;
```

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Now you can get the best for less! Just clip out the coupon below bring it to your local computer store, and you'll get $1.00 off the list price of any program package from Instant Software!

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BUSINESS PACKAGE IV Business Package IV gives you, the businessman, a superb tool to help you make those important decisions. This package includes:

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Business Package IV, with its combination of analytic functions and convenience features, is an invaluable asset for any businessman. All you need is a TRS-80 Level I 4K or Level II 16K.
Order No. 0019R $9.95

AIRMAIL PILOT The Airmail Pilot package takes you back to the early days of aviation. Your plane is the Curtis JN4-D, affectionately known as the Jenny, and your mission is to fly the mail from Columbus to Chicago.

The Jenny carries only 26 gallons of fuel. You'll have to stop along the way. Bad weather may force you down. Electrical storms may turn your aircraft into a mass of flaming wreckage, or ice may form on your wings and plunge you to certain death below. But the mail must get through.

The onboard clock will show your elapsed time. Your mission is to complete the flight as quickly as possible.

With the Airmail Pilot package, you can experience the thrills of flying when aircraft were mere fragile machines of wood and fabric. (Scarf and leather helmet optional.) This program requires a 16K TRS-80 Level II.
Order No. 0106R $7.95.

TEACHER

What do you need to learn? Would you like to know all of the cranial nerves? Electronic color codes? Civil War battles? Signs of the zodiac? Whatever your subject matter, the Teacher package can help you learn it. You simply input up to twenty questions and answers at one time. Next, review the material, and then take the test until you have your lesson down pat. The program gives you up to three hints per question and even offers graphic rewards for children, all at your discretion. All the information can be saved on cassette tape for reuse.

This package also contains the Teacher Data Transfer program, which allows you to combine several tests on one tape. That means you can learn a number of lessons sequentially without changing tapes.

Teacher is an effective instrument for anyone who needs to learn a lot of material in the shortest possible time. For decades leading educators and computer scientists alike have been promoting the future role of computers in education. Now you and your family can reap the benefits of computer-assisted instruction in your own home. The program is furnished with a blank data cassette tape. You'll need a TRS-80 Level II 16K.
Order No. 0065R $9.95.

SANTA PARAVIA AND FIUMACCIO The year is AD 1400, and you are the ruler of a tiny Italian city-state. You are ambitious by nature and intend to build your little city-state into a powerful kingdom.

So begins Santa Paravia and Fiumaccio, where you and your fellow players compete as rulers of neighboring cities. You control the grain harvest, feed your people, set tax rates, exercise justice, invest in public works and, of course, try to stay on the good side of the church.

Life was short back then, and you'll have only a limited amount of time in which to build your kingdom. The lives of your serfs will depend on your decisions. If they are wise, then your city-state will grow and you will acquire loftier titles. If your rule is incompetent, your people will starve and your city-state may be invaded by your neighbors.

You can play the game yourself, or set up the tournament version, which allows up to six players at a time to compete. Either way, you're sure to find your route to the throne a challenging and rocky road.

How will you rule your kingdom? Will you be a benevolent ruler—an iron fist in a velvet glove—or will you become unscrupulous and follow the example set by Niccolo Machiavelli in his book on government, *The Prince*? Only *you* can answer that question—with Santa Paravia and Fiumaccio.
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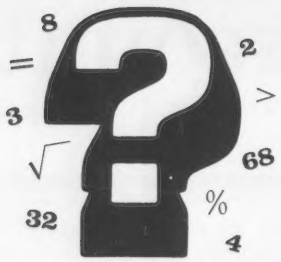


What's Your Math IQ?

Howard Berenbon

Have you ever wondered what your math aptitude is? Well, here's a program that will test your math I.Q. with a 15 minute, 20 question test.

The "Math I.Q. Test Program" is written in BASIC and will run in most popular home computer systems including the TRS-80 Level I and Level II, Apple II, PET and SWTPC 6800 system. It requires approximately 2.5K of RAM to operate.

After running the program, it requests entry of a '1' to begin the test. The test consists of 20 difficult math problems. Here's an example of the type of questions given:

ENTER THE MISSING NUMBER
1) 3 8 6 3?
ANSWER: 3968

Before beginning, set a timer for 15 minutes. A time limit is required so that you answer the questions you can solve quickly. Use paper and pencil, or a calculator, to figure out the answers. Take about 45 seconds per question. If you can't find an answer then skip the question by entering any number. The test will advance to the next question, but once you enter an answer you can't go back and change it.

You won't solve all 20 problems in the allotted time. Therefore, when the time is up enter a '1' for each problem left through 20. Your score will be printed along with a graph of I.Q. versus score. To find your I.Q., draw a vertical line from your score to the diagonal line (see Figure 1). Then draw a horizontal line from the diagonal, left to the I.Q. number.

```
YOU HAVE 8  CORRECT OUT OF 20
FIND YOUR I.Q. FROM THE GRAPH BELOW
I.Q.
150                                  *
140                              *
130                          *
120                      *
110                  *
100              *
90           *

         3   5   7   9   12  13  15
                  SCORE
TO DISPLAY ANSWERS ENTER A <1>
```

Figure 1

A score of 15 out of 20 will indicate an I.Q. of about 150 (genius). The average I.Q. is around 100, which is a score of 6.

Howard Berenbon, 2681 Peterboro, W. Bloomfield, MI 48033.

To display the answers type a '1' after the graph is printed.

The test gives only an approximate indication of your math intelligence quotient. If you're interested in a more detailed and accurate I.Q. study, contact your local college or university for testing. Most colleges offer several different types of intelligence and career testing. Tests can last from several hours to several days.

A cassette of the "Math I.Q. Test Program" is available for the TRS-80 Level I and Level II for $4.95 plus $.50 for postage and handling. Write:

Software Exchange
2681 Peterboro
W. Bloomfield, MI. 48033 □

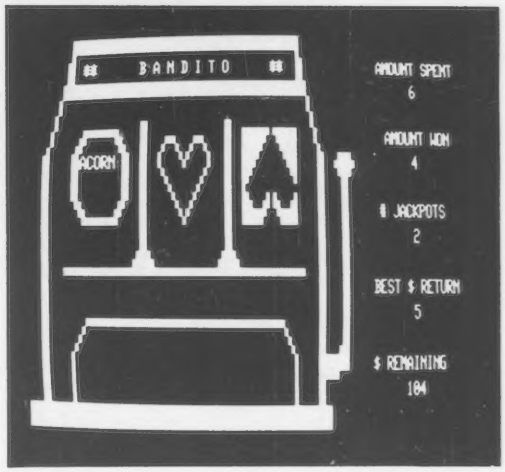
```
0100 PRINT "MATH I.Q. TEST"
0110 PRINT
0120 PRINT "COPYRIGHT (C) 1979 BY HOWARD BERENBON"
0130 PRINT
0140 PRINT "YOU HAVE 15 MINUTES TO COMPLETE 20 QUESTIONS."
0150 PRINT "IN ALL CASES ENTER THE MISSING NUMBER."
0160 PRINT
0170 PRINT "ENTER A (1) TO BEGIN"
0180 INPUT A
0190 IF A<>1 THEN 170
0200  C=0
0210 GOSUB 2000
0220 PRINT "1)"
0240 PRINT "4 8 6"
0250 PRINT "6 2 4"
0260 PRINT "8 6 ?"
0270 INPUT B
0280 IF B=7 GOSUB 2200
0290 GOSUB 2000
0300 PRINT "2)"
0310 PRINT "7 13 24 45 ?"
0320 INPUT B
0330 IF B=86 GOSUB 2200
0340 GOSUB 2000
0350 PRINT "3)"
0360 PRINT "6 10 18 34 ?"
0370 INPUT B
0380 IF B=66 GOSUB 2200
0390 GOSUB 2000
0400 PRINT "4)"
0410 PRINT "212 179 146 113 ?"
0420 INPUT B
0430 IF B=80 GOSUB 2200
0440 GOSUB 2000
0450 PRINT "5)"
0460 PRINT "4 1 2"
0470 PRINT "2 6 3"
0480 PRINT "3 2 ?"
0490 INPUT B
0500 IF B=4 GOSUB 2200
0510 GOSUB 2000
0520 PRINT "6)"
0530 PRINT "4 5 7 11 ?"
0540 INPUT B
0550 IF B=19 GOSUB 2200
0560 GOSUB 2000
0570 PRINT "7)"
0580 PRINT "9 4 1"
0590 PRINT "6 6 2"
0600 PRINT "1 9 ?"
0610 INPUT B
0620 IF B=4 GOSUB 2200
0630 GOSUB 2000
0640 PRINT "8)"
0650 PRINT "8 2 4"
0660 PRINT "1 5 3"
0670 PRINT "1 3 ?"
0680 INPUT B
0690 IF B=3 GOSUB 2200
0700 GOSUB 2000
0710 PRINT "9)"
0720 PRINT "6 7 9 13 ?"
0730 INPUT B
```

IQ, con't . . .

```
0740 IF B=21 GOSUB 2200
0750 GOSUB 2000
0760 PRINT "10)"
0770 PRINT "1 5 13 29 ?"
0780 INPUT B
0790 IF B=61 GOSUB 2200
0800 GOSUB 2000
0810 PRINT "11)"
0820 PRINT "2 10 4"
0830 PRINT "3 17 5"
0840 PRINT "3  ? 6"
0850 INPUT B
0860 IF B=20 GOSUB 2200
0870 GOSUB 2000
0880 PRINT "12)"
0890 PRINT "2 8 5 6 8 ? 11"
0900 INPUT B
0910 IF B=4 GOSUB 2200
0920 GOSUB 2000
0930 PRINT "13)"
0940 PRINT "2 8 20 44 ?"
0950 INPUT B
0960 IF B=92 GOSUB 2200
0970 GOSUB 2000
0980 PRINT "14)"
0990 PRINT "5 25 85 265 ?"
1000 INPUT B
1010 IF B=805 GOSUB 2200
1020 GOSUB 2000
1030 PRINT "15)"
1040 PRINT "24 26 30 38 ?"
1050 INPUT B
1060 IF B=54 GOSUB 2200
1070 GOSUB 2000
1080 PRINT "16)"
1090 PRINT "2 6 38 ?"
1100 INPUT B
1110 IF B=1446 GOSUB 2200
1120 GOSUB 2000
1130 PRINT "17)"
1140 PRINT "5 9 4 6 8 ?"
1150 INPUT B
1160 IF B=2 GOSUB 2200
1170 GOSUB 2000
1180 PRINT "18)"
1190 PRINT "€ 8 10 11 14 14 ?"
1200 INPUT B
1210 IF B=18 GOSUB 2200
1220 GOSUB 2000
1230 PRINT "19)"
1240 PRINT "1 6 41 ?"
1250 INPUT B
1260 IF B=1686 GOSUB 2200
1270 GOSUB 2000
1280 PRINT "20)"
1290 PRINT "200 162 124 ?"
1300 INPUT B
1310 IF B=86 GOSUB 2200
1320 PRINT
1330 PRINT "YOU HAVE ";C;" CORRECT OUT OF 20"
1340 PRINT "FIND YOUR I.Q. FROM THE GRAPH BELOW"
1360 PRINT "I.Q."
1370 PRINT "150";TAB(35);"*"
1380 PRINT "140";TAB(31);"*"
1390 PRINT "130";TAB(26);"*"
1400 PRINT "120";TAB(22);"*"
1410 PRINT "110";TAB(18);"*"
1420 PRINT "100";TAB(14);"*"
1430 PRINT "90";TAB(10);"*"
1440 PRINT
1450 PRINT "        3   5   7   9    12  13   15"
1470 PRINT TAB(18);"SCORE"
1480 PRINT "TO DISPLAY ANSWERS ENTER A (1)"
1490 INPUT D
1500 IF D<>1 THEN 1600
1510 PRINT TAB(18);"ANSWERS"
1520 PRINT
1530 PRINT "1)=7  2)=86  3)=66  4)=80  5)=4"
1540 PRINT "6)=19  7)=4  8)=3  9)=21  10)=61"
1550 PRINT "11)=20  12)=4  13)=92  14)=805  15)=54"
1560 PRINT "16)=1446  17)=2  18)=18  19=1686  20)=86"
1600 END
2000 PRINT
2010 PRINT "ENTER MISSING NUMBER"
2020 PRINT
2030 RETURN
2200  C=C+1
2210 RETURN
```

WITH SOUND

BANDITO



Take the gamble.

Pull the arm on *Bandito*, the graphic TRS-80* slot machine with sound effects.

Hear the *Bandito's* arm creak as it moves. Wait anxiously as the spinning and clicking wheels slow to a stop. And, if your luck holds out, you'll see your winnings pile up!

Bandito will provide hours of fun and entertainment on your TRS-80 microcomputer. The fast graphics are excellent animation and the sound effects give the feeling of actually playing the slots. *Bandito* is good for demonstrating your computer to friends, a great party program, and enjoyable entertainment at any hour.

Sound effects on *Bandito*, as on all Acorn programs, are made through the cassette cables. You just plug a small speaker amplifier into the AUX cable and you'll hear the arm creak, the wheels spin, and the winnings pile up.

Acorn produces several programs with sound effects. These include *Star Warp* and *Lunar Lander, Alien, Star Trek, Ting-Tong, Music, Codebreaker, Word Challenge* and more. All available for $9.95 for a 16K, Level II TRS-80. Ask for these quality programs at your local computer store.

* TRS-80 is a trademark of Tandy Corp.

Acorn
Software Products, Inc.

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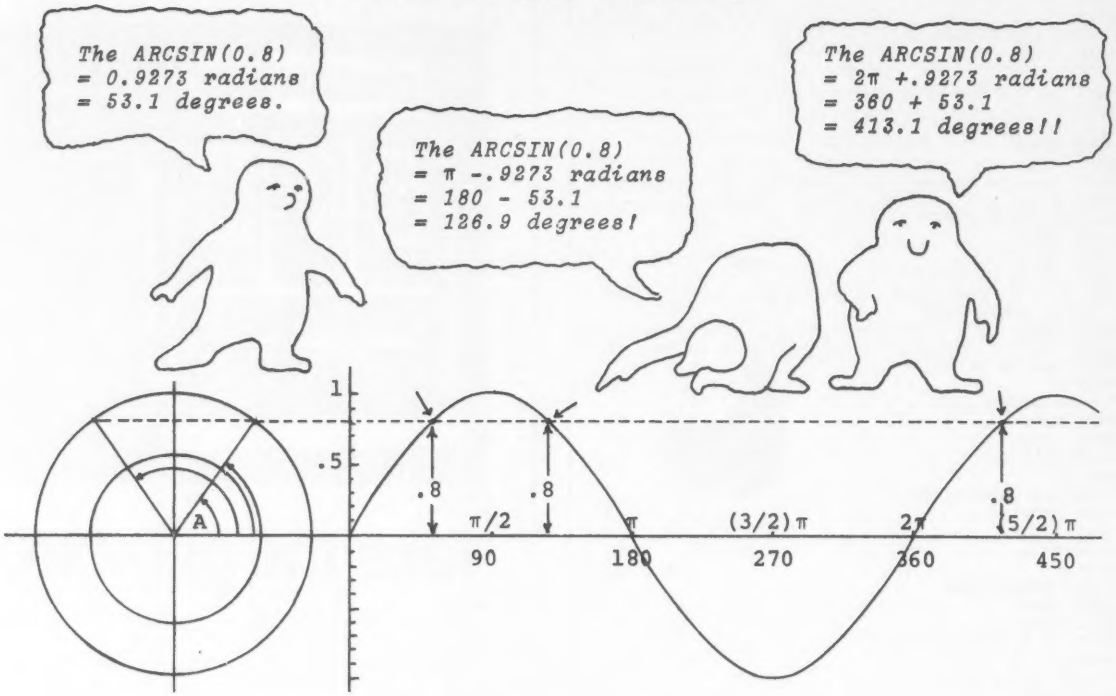
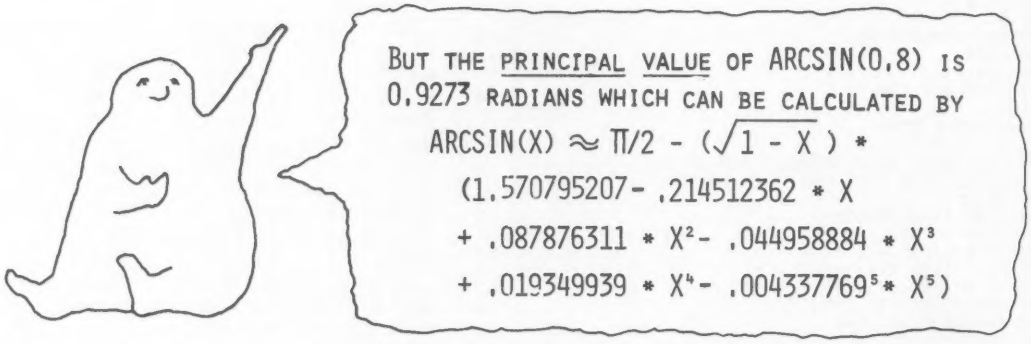
CIRCLE 107 ON READER SERVICE CARD

INVERSE CIRCULAR FUNCTIONS




BUT THE PRINCIPAL VALUE OF ARCSIN(0,8) IS 0,9273 RADIANS WHICH CAN BE CALCULATED BY
ARCSIN(X) ≈ π/2 - (√1 - X) *
(1,570795207- ,214512362 * X
+ ,087876311 * X²- ,044958884 * X³
+ ,019349939 * X⁴- ,004337769⁵* X⁵)

This is a reprint of one of the original Project Solo curriculum modules developed at the University of Pittsburgh. Project Solo was supported in part by the National Science Foundation, and it was directed by Tom Dwyer and Margot Critchfield. The modules were authored by various persons, including project staff, teachers, and students.

It should be kept in mind that Project Solo began in 1969 (which is probably before some of Creative's readers were born.) Undoubtedly, many of the modules would be done differently today. There are also surely errors to be found, and neither Creative Computing, the authors, or NSF can warrant the accuracy of the reprints. But as a starting point for your own explorations, they should make a good (albeit slightly ancient) set of shoulders to stand upon. We hope you enjoy the view.

Inverse Circular, con't...

In the module on trigonometric functions we saw that polynomial approximations are used by computers to calculate the circular (or trigonometric) functions when the independent variable is the angle.-----The simple program:

```
10 LET A=.9273
20 PRINT "A=";A,SIN(A)=";SIN(A)
RUN
```

will result in the output:

```
A=.9273          SIN(A)=.800002869
```

In order that the computer successfully execute this program it must use one of the Hastings approximations for finding SIN (.9273). (See Problem 3 in the module "TRIG. FUNCTIONS AND TCHEBYCHEV APPROXIMATIONS".)

The Inverse Problem

Now suppose we ask the computer to

```
10 PRINT ARCSIN(.8)
20 END
RUN
```

we will obtain:

```
0.927295218
```

We have asked the computer to print:

> "the angle which has a sine of 0.8"

or to be exact:

> "Print the angle A (in radians) such that SIN(A) = 0.8, and A lies in the interval $-\pi/2 \leq A \leq \pi/2$

The cover of this module shows why we have to agree on an interval for A. The inverse function ARCSIN is **not** single valued, and so we must eliminate confusion by using the (unspoken) assumption that the **principal** value of A will be calculated. For the SINE function, the principal value is found in either quadrant I or quadrant IV.

Hastings Sheet 35

The formula for approximating ARCSIN(X) shown on the front cover is Hastings' Sheet 37, a rather accurate formula. It assumes that X is limited to the range

$0 \leq X \leq 1$

Here is a program to use a simpler but less accurate formula (Hastings' Sheet 35) to calculate the ARCSIN function. The program also prints the more accurate ARCSIN function for comparison. The Sheet 35 formula is:

$$\text{ARCSIN}(X) \doteq \pi/2 - (\sqrt{1-X}) * (1.5707288 - .2121144 * X + .0742610 * X * X - .0187293 * X * X * X)$$

```
PROGRAM TO COMPARE LIBRARY ARCSIN FUNCTION
WITH HASTINGS 35 FUNCTION

ARGUMENT              LIBRARY                HASTINGS 35
-------------------------------------------------------
0                     0                      6.620000204E-05
0.1                   0.100167421            0.100107027
0.2                   0.201357921            0.201313803
0.3                   0.304692654            0.304700575
0.4                   0.411516846            0.411559864
0.5                   0.523598776            0.523643617
0.6                   0.643501109            0.643521213
0.7                   0.775397497            0.775385477
0.8                   0.927295218            0.927265853
0.9                   1.119769515            1.119751877
1                     1.570791655            1.570789605

LIST

500 PRINT "PROGRAM TO COMPARE LIBRARY ARCSIN FUNCTION"
501 PRINT "WITH HASTINGS 35 FUNCTION" : PRINT : PRINT
510 LET A0=1.5707288 : LET A1=-.2121144
520 LET A2=.0742610  : LET A3=-.0187293
530 LET P=3.14159/2
540 PRINT "ARGUMENT              LIBRARY                HASTINGS 35"
550 PRINT "-------------------------------------------------------"
560 FOR X=0 TO 1 STEP 0.1
570 D=((A3*X+A2)*X+A1)*X+A0
580 S=P-SQRT(1-X)*D
590 PRINT X;TAB(20);ARCSIN(X);TAB(40);S
600 NEXT X
610 END
```

Notice that polynomial is evaluated using nested multiplication in line 560 in order to reduce the number of multiplications. Why is this important?

Problem 1

Improve the above program so that X may lie in the interval $-1 \leq X \leq 1$. Test your program by running it with line 550 changed to:

```
550 FOR X=-1 TO 1 STEP 0.1
```

[HINT: RECALL THAT SIN(-X) = -SIN(X)]

Problem 2

Find out what happens when you type

```
10 PRINT ARCSIN(2)
20 END
RUN
```

Can you make your program do the same for the Hastings 35 approximation? Or do you have to?

Problem 3 (OPTIONAL)

Change your program to use the Hastings Sheet 36 formula:

$$\text{ARCSIN}(X) \doteq \pi/2 - (\sqrt{1-X})(1.57078786 - 0.21412453 * X + 0.08466649 * X * X - 0.03575663 * X * X * X + 0.00864884 * X * X * X * X)$$

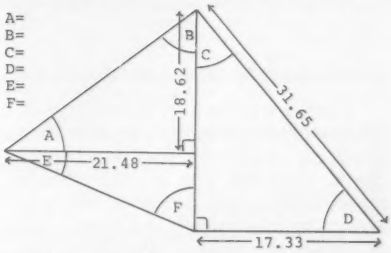
Use $\pi = 3.14159265$

Problem 4 (OPTIONAL)

Run the program for Problem 3 again, using Hasting's 37 (see illustration on previous page) and Double Precision. Some computers have double precision directly available. For those that do not, see the article "Computing Factorials—Accurately" by Walter Koetke (Creative Computing, Vol. 1, No. 3, pg. 9 or Best of Creative Computing, Vol. 1, pg. 172). Use $\pi = 3.141592653589793238$.

Problem 5

In practice, library functions are used for calculation. Practice using the ARCSIN(X), the ARCCOS(X), and the ATAN(X) functions* to find the angles A, B, C, D, E, F in the figure below. (Use direct mode if you wish.)



Many BASIC languages do not have the ARCSIN function. You will have to improvise your own. One way is to create a user-defined function which expresses the arcsin function in terms of built-in functions. For example:

```
10 DEF FNA(X)=ATN(X/SQR(-X*X+1))
```

Later, if you want to print ARCSIN(.1), you'd say

```
500 PRINT FNA(.1)
```

*Many computers do not have ARCSIN or ARCCOS functions. Can you still do this problem?

You should be able to amaze at least three friends with this mystifying magic trick. An alternate presentation requiring only one friend is included for use by professional programmers. While learning how to become a master magician you will also find out about a unique method of simulating binary computer circuits with a few pennies.

Introducing The Three Cent Computer

Believe it or not, in these days of double digit inflation, you can construct a computer for only three cents. Granted, it's a very simple binary computer...but what do you expect at this price? The three cent computer is shown in Figure 1. You just have to add three pennies to make it operational.

Put one penny in each of the three circles. Each penny should be tails up initially. Start at arrows A,B, or C to operate the computer. Follow the arrow to a penny and turn that penny over. If the penny is left heads up, follow the arrow marked HEADS away from the penny. If the final penny position is tails up, then follow the arrow marked TAILS away from the penny. If an arrow leads you to the STOP box, you're done. If an arrow leads you to another penny, turn this penny over. Follow the appropriate arrow away from this new penny. Sooner or later you'll always arrive at the STOP box.

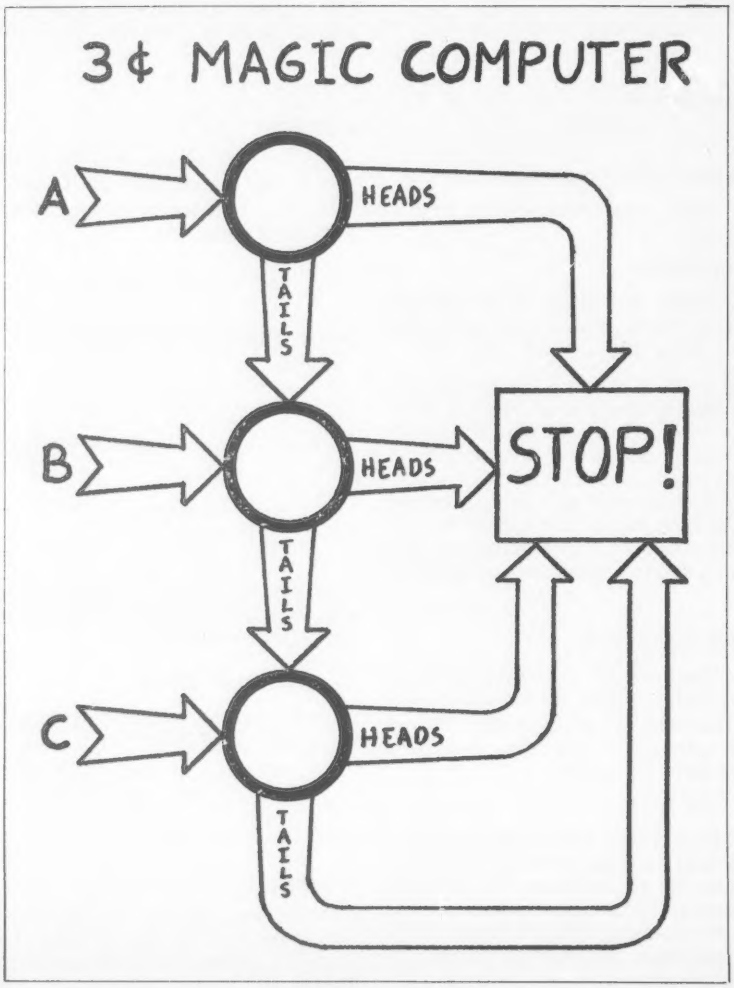


Figure 1 Penny Computer

What's NEW from SOFTAPE

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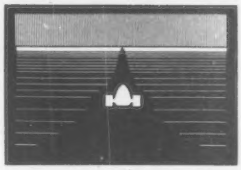
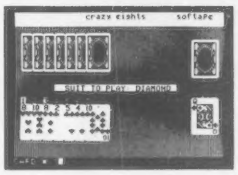


CRAZY 8's

Crazy 8's is a card game using Bill Depew's HIRES playing cards. One player can play the APPLE. The beginner can select the option of seeing the APPLE's hand while playing.

Crazy 8's is an easy to learn card game. Great for all ages. Requires 24K.

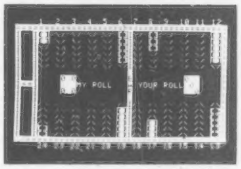


MICROGAMMON 1.0

Pit your mental skill and luck against that of the Apple with this computer implemented version of the popular board game Backgammon. All the moves are displayed on the video screen along with tha board layout and pieces.

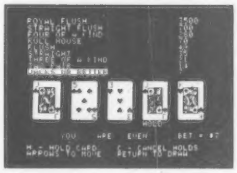
This program requires at least 16K of memory to run from cassette and 32K of memory to be stored and played from an Apple II Disk System. No additional handware is needed.

Learn, practice, and enhance your Backgammon ability a true competitor. (To our knowledge, the Apple doesn't cheat!!!)



SOLITAIRE POKER

The ultimate poker machine! SOLITARE POKER simulates the poker machines that line the Las Vegas strip. Practice your poker ability with Hires playing cards. SOLITARE POKER is a sure winner! Requires 24K.



Two More By Steve Baker

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The ancient game of five men in a row. You play against a machine language routine with three levels of excellence. A Hires board using SCREEN MACHINE gives this game the beauty and style of chess. Requires 16K.

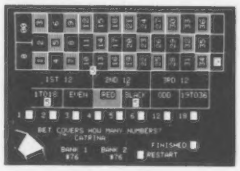
FIGHTER PILOT

It's war, and your mother ship is under attack. The adrenelin flows as you accelerate through the launch tube and penetrate the void of space. With all systems operating, your sensors show the direction of the enemy racing to meet you. After a few bursts he explodes, and you fly through his debris to meet the next one.

FIGHTER PILOT is a fast-moving game of excitement and skill. This graphics program, written in integer basic, requires 16K of memory.

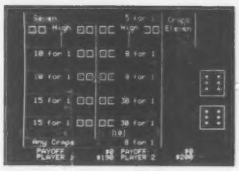
ROULETTE

Roulette is a realistic duplication of the popular casino favorite using HIRES graphics and a spinning wheel. Bets can be placed with the keyboard or you can use SOFTAPE's BRIGHT Pen. One or two players can bet against the house. Requires 24K.



CRAPS

Play Las Vegas Craps on a high resolution playing table created by your APPLE. Place bets, play the field, passline and hardway rolls . . . all are possible with this detailed simulation. Dice rolls are animated on the screen. Improve your game or devise your own "system". Craps requires INTEGER BASIC and 24K or memory. BONUS!! Included on the back side of the tape is Bright Pen™ Craps for those lucky guys with the SOFTAPE Bright Pen. You will be amazed how easily moves are made and how fast the game progresses!!



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Magic, con't . . .

Every computer has to have input, storage, processing, and output circuits. The penny computer inputs are the A,B, and C arrows. Working storage or memory is provided by the pennies which can each be set to one of two states. The processing function is determined by the interconnecting arrows. Output is obtained by looking at the states (heads or tails) of the three pennies. If heads represents binary 1 and tails equals binary 0, then the three pennies can represent a 3-bit binary number as illustrated in Figure 2.

DECIMAL	PENNY C	PENNY B	PENNY A
0	TAIL(0)	TAIL(0)	TAIL(0)
1	TAIL(0)	TAIL(0)	HEAD(1)
2	TAIL(0)	HEAD(1)	TAIL(0)
3	TAIL(0)	HEAD(1)	HEAD(1)
4	HEAD(1)	TAIL(0)	TAIL(0)
5	HEAD(1)	TAIL(0)	HEAD(1)
6	HEAD(1)	HEAD(1)	TAIL(0)
7	HEAD(1)	HEAD(1)	HEAD(1)

Figure 2 Penny Conversion Table

An example should clarify the operation of this penny computer. First place tails up pennies in the three circles. The output state of the computer is now equal to decimal 0. The three tails are equivalent to binary 000 which is the same as decimal 0 as shown in Figure 2. Each time you start at arrow A you will increment this 3-bit binary number by one. Try it and see. Starting at arrow A the first time, flip penny A to heads and follow the HEADS arrow to the STOP box. As seen in Figure 2, the pennies now represent binary 001 or decimal 1. Start at arrow A again. This time penny A is flipped to tails and you follow the TAILS arrow away from it. This takes you to penny B which you flip over to heads. The HEADS arrow now leads you from penny B to the STOP box and you're done. You've started at arrow A twice and the pennies represent binary 010 or decimal 2. If you had started at arrow A five times the pennies would represent binary 101 or decimal 5. This computer is actually simulating a 3-bit binary counter. Each of the pennies represents an electronic flip-flop.

You have seen how starting at arrow A adds one to the simulated 3-bit binary counter. Starting at arrow B will add two to the value of the counter. Starting at arrow C will add four. If you don't believe this, try it out. Remember, when the counter reaches binary 111 (decimal 7), adding one more will change it to 000. Adding two or four will change it from decimal 7 to decimal 1 or 3, respectively. Adding more pennies would permit larger numbers to be represented. A 3-bit binary number is all that's required for the trick described here.

These penny flip-flops make it easy to see how certain binary computer circuits work. This article, however, is more concerned with having fun than with learning about computer circuits. Later on you might want to use the penny switch to understand computer circuits. For now we'll drop the theory and move on to the magic. You can use the three cent computer to perform a mystifying trick even if you don't care about binary logic.

A Penny Computer Magic Trick

For this trick you'll need three pennies, one quarter, one nickel, and one dime. You should make a copy of the penny computer shown in Figure 1 and glue it to a piece of cardboard. Copy the three instruction cards shown in Figure 3. Cut them out and mount them on cardboard. You're now ready to perform this mystifying trick for your friends. Remember that even Houdini had to start somewhere.

First show how the penny computer works. You don't have to explain the theory or mention binary numbers. Just make sure that when someone is later told to start at A,B, or C they'll know what to do. Here's where your choice of friends is critical. You don't want ones that are too smart to be fooled by this trick. At the same time, they have to be smart enough to learn how to operate the penny computer. No one ever said that the life of a magician is easy, which is probably why you're reading a computer magazine.

Next give three different people the instruction cards. Each person gets one of the three cards.

Now show the nickel, dime, and quarter. Explain that you will turn your back or leave the room. The three people with the instruction cards are to each take one of the three coins. The person who takes the nickel will start at the penny computer arrow named on his instruction card when it's his turn. Likewise for whoever takes the dime and quarter. When each of the three is finished, you ask one or two questions and amazingly name the coin chosen by each person.

An example will clarify how the trick works. Suppose the person with card 1 takes the nickel, the person with card 2 takes the dime, and the person with card 3 takes the quarter. The coins can be covered with the appropriate cards so that no one forgets which coin they took. Stress that each person picked a coin after you left the room so you have no way of knowing who picked which coin.

Now the three people arbitrarily decide in what order they'll operate the penny computer. Suppose number 2 goes first. Since person number 2 took the dime, she will start at arrow C according to instruction card 2. This leaves penny C heads up with the others still showing tails.

Suppose number 1 decides to go next. According to instruction card 1 this person will also start at arrow C since the nickel was chosen. After this turn all three pennies will show tails again. Now number 3 takes a turn starting at arrow B since the quarter was chosen. After this turn only penny B will show heads. The players now tell you that they have each completed their turn.

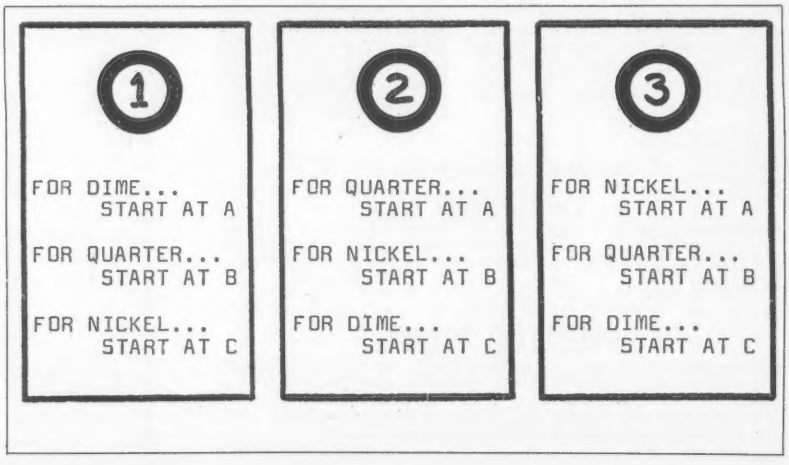

Figure 3 Instruction Cards

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Magic, con't . . .

You remind your three assistants that you had no influence over who took the nickel, dime and quarter. You also had no way of knowing in what order they used the penny computer. Ask them only to tell you how many pennies are heads up. In this example they should tell you that one penny is heads up. Hearing this, you are immediately able to announce that the person with instruction card 1 took the nickel. You then ask if arrow A points to the heads up penny. In this case the answer should be no. Based on this answer you announce that assistant 2 took the dime and number 3 took the quarter.

You can now turn around or come back into the room and receive your applause as a master magician. The trick can be repeated again. Just make sure that the penny computer is reset to three tails showing before you start. Figure 4 shows how to identify who picked the nickel, dime, and quarter based on one or two questions about the final penny positions.

How it Works

This trick is self working when you follow the directions provided above. For showing to one friend, just have the three instruction cards placed over the nickel, dime, and quarter while you're out of the room. Have your friend operate the penny computer one for each instruction card based on whether it covers the nickel, dime, or quarter.

There are six possible pairings of the nickel, dime, and quarter with the three instruction cards. These six possible combinations are shown in Figure 5. The rules on the instruction cards result in a different arrangement of the three pennies for each of the six possible card-coin combinations. The left hand column of Figure 5 shows the decimal equivalents for the six possible penny arrangements. The questions in Figure 4 were derived from the penny states shown in Figure 5.

This trick is a variation on a very old one using matches or cards. In one version 24 matches are used. Three people each choose one of three different objects such as the nickel, dime, and quarter used here. They are then given instructions as to how many matches to take based on which object they chose. The magician then identifies each person's object based only on the number of matches remaining. Since 1900 many versions of this trick have been published in books. The version described here brings the trick up to date by using a 3-bit binary counter to replace the matches or cards normally used.

Conclusion

Penny logic is a unique way to illustrate the operation of simple binary computer circuits. This article introduced you to the penny logic approach with a magic trick. More penny logic fun is available in my book **Computer Coin Games**. A portion of the selling price goes into the retirement fund of a worthy author for whom I can personally vouch. This book provides an easy way to understand simple computer circuits. It also provides a variety of fascinating penny logic games. These games are fun whether or not you're interested in computer circuits. After reading **Computer Coin Games** you might want to design your own penny logic games, tricks, and teaching aids. Educators will find that the penny logic approach is an ideal way to introduce binary number concepts. □

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Figure 5 Distribution Table

Computer Coin Games is available for $3.95 plus .75 shipping and handling ($1.75 foreign) from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960. Substantial quantity discounts are available to schools and stores for orders of 20 or more copies.

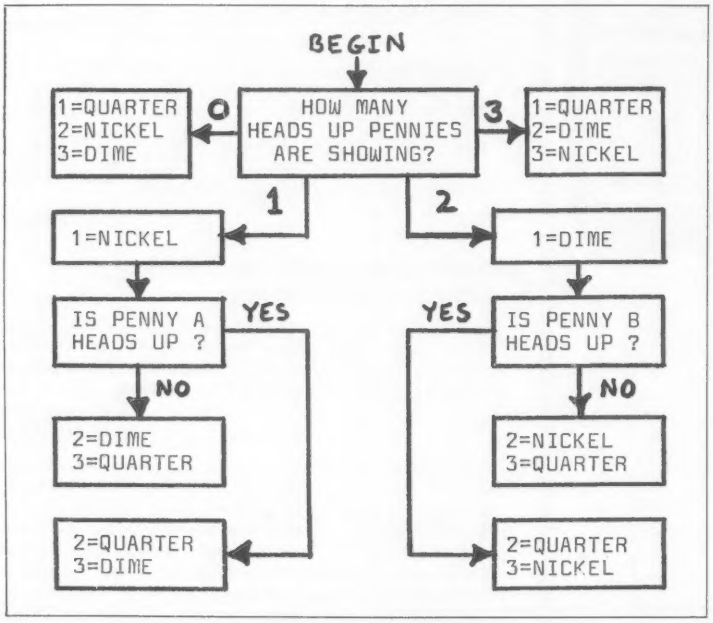
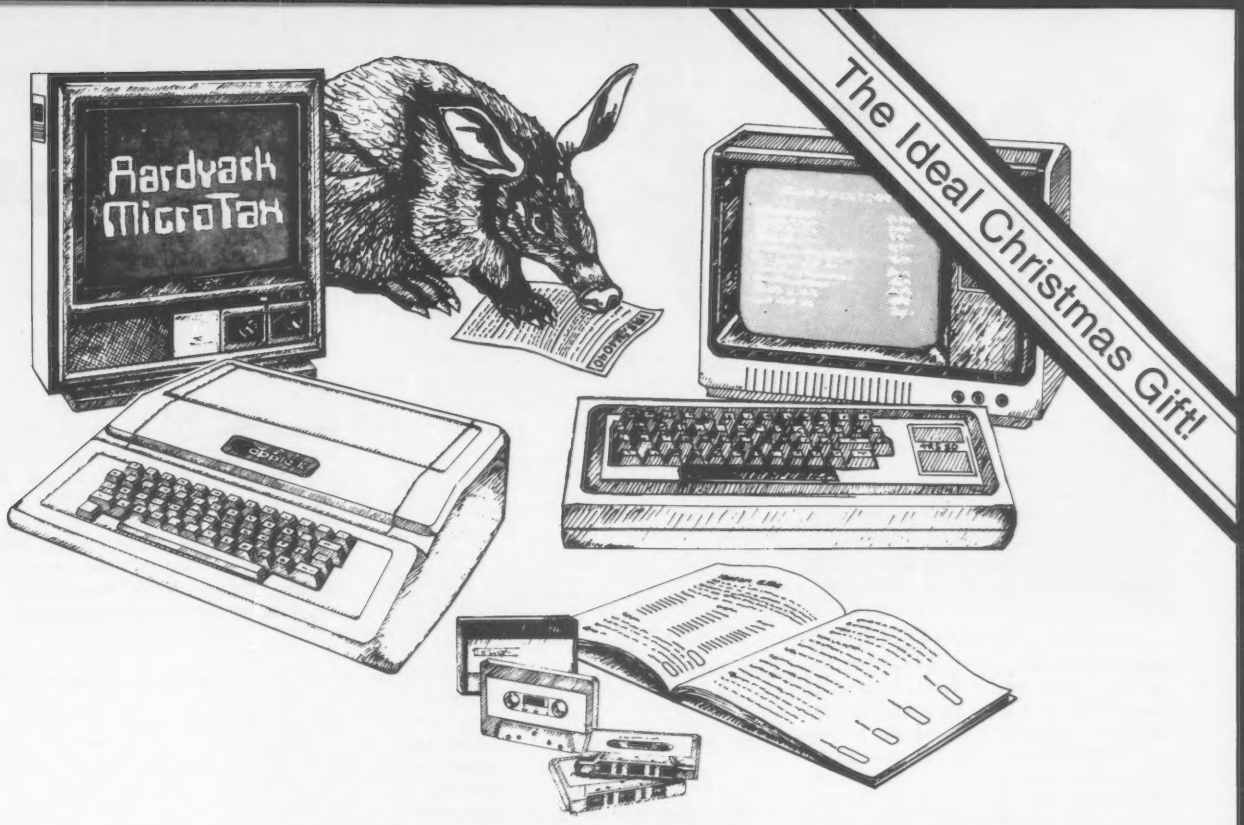


Figure 4 Question & Answer Flow Chart

"Well, you can see right here the computer says that you're dead."



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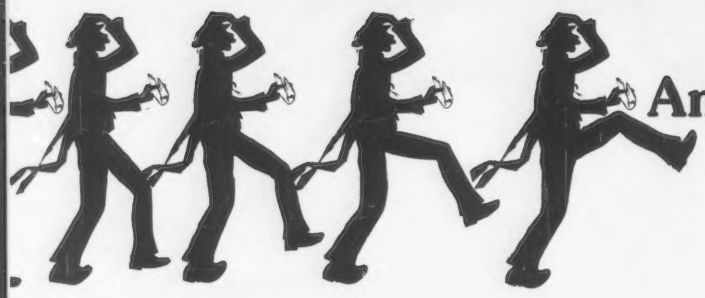


Animation for the Apple

Mitchell Waite

Mitchell Waite, co-author of **Microcomputer Primer** (Howard W. Sams; $7.95), has written a new book for Apple graphics enthusiasts. Following is an excerpt from **Computer Graphics Primer** (reprinted with permission from Howard W. Sams).

Animation on the computer is so new and so revolutionary that very few of the new home computers are capable of it. And to be sure, even the Apple is not totally set up for animation from BASIC, but it's darn close. The main requirements for computer animation are dense display formats and a high speed BASIC. If BASIC is slow there will be objectional flicker and if the screened display is not dense enough the movement will not be fluid.

What Is An Animation?

An animation is a series of pictures, each slightly different than the one before it, presented to the viewer at a fast enough rate to give the impression of smooth movement. A simple object can be made to move across the screen by constant plotting and replotting of the object. This is very trivial animation. True animation can best be illustrated by simulating a moving figure such as a running bird, walking man and so on. With moving figure animation we must be able to present a series of pictures of the object with the elements of the object (like the limbs) slightly displaced from the one before it. If we want total realism, we should show all bends, tilts, and other subtle changes that occur as the figure moves.

There are several ways to approach this problem from the viewpoint of programming. The best approach would be to use assembly language because it is so fast, but this would be beyond the scope of our objectives, and only a small number of professional programmers would understand it. The next best approach, and the one used here, is to do the animation with BASIC.

Mitchell Waite, 111 Greenbrae Boardwalk, Greenbrae, CA 94904

Walking Animation

Consider for a moment how we walk. Our upper legs (thighs) are hinged to our hips so they swing freely. Our lower legs (calfs) are hinged to our thighs at the knee, and they, too, swing in an arc. Finally, our feet are attached to our calfs so that they, too, swing in a small arc. In general, all legs and arms have this feature of rotation. Does this suggest a technique that might be used on the Apple to create an animation of walking?

PROBLEM: Write a program that animates a walking bird (knees bend backward compared to people's) on the Apple. Use a shape table with a single vector in it to represent one of the sections of a leg. Have rotation values stored in DATA statements that set the position of the legs for each frame of the animation. Have the legs divided into an upper leg hinged at the hip, a lower leg hinged at the knee and a foot hinged at the bottom of the lower leg. Since we have two legs, there will be six parts, with six rotations per frame or per DATA statement.

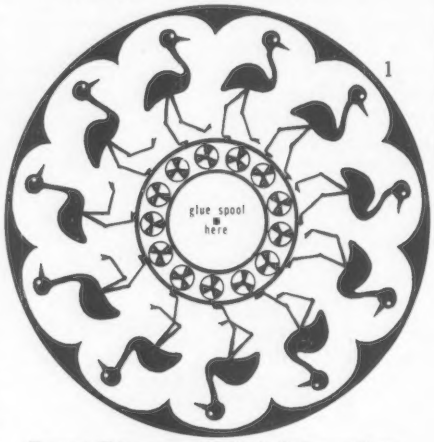
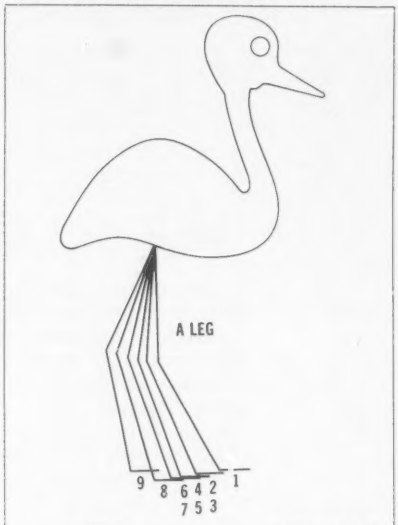
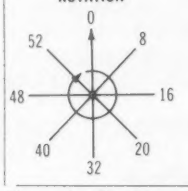


Figure 1. This was used to obtain the leg positions for the bird animation program. You can find other such drawings for making animation programs in **Paper Movie Machines** by Budd Wentz, Troubador Press, San Francisco, © 1975.

SOLUTION: Begin by obtaining a source of animation frames for use in the program such as the one shown in Figure 1. If you can't find such a source, you can make cardboard figures with hinged limbs to imitate the movements. Figures 2(a) and 2(b) represent one of several steps of the animation, each diagram showing all the positions of a leg for the entire animation. A leg follows a simple shifting motion while the B leg has much more extended movements.





	A LEG	B LEG
1 DATA	32.26.16.	38.30.16
2	33.26.16.	42.32.18
3	33.26.16.	44.33.20
4	34.27.16.	45.24.18
5	34.27.16.	43.22.12
6	35.28.16.	38.18.13
7	35.28.16.	32.14.08
8	36.29.16.	30.16.14
9	36.29.16.	32.20.12

Figure 2a. The leg rotations for the animation program 'A' leg
Rotation: 0 8 16 20 32 40 48 52

	'A' LEG	'B' LEG	
1 DATA	32.26,16,	38,30,16	1
2	33,26,16,	42,32,18	2
3	33,26,16,	44,33,20	3
4	34,27,16,	45,24,18	4
5	34,27,16,	43,22,12	5
6	35,28,16,	38,18,13	6
7	35,28,16,	32,14,8	7
8	36,29,16,	30,16,14	8
9	36,29,16,	32,20,12	9

Next we conver the angled positions of the legs to numbers in DATA statements. The first three numbers are the A leg rotations, the next three the B leg. Our next step is to write a program to use this data.

Animation, con't . . .

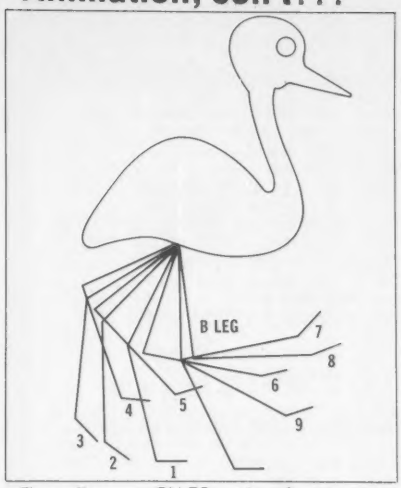


Figure 2b. 'B' LEG

1	6
2	7
3	8
4	9
5	10

The Animation Program

Program A is very simple considering what it accomplishes. It begins by setting HIMEM: to 8046. Next, variables INC and MAX are initialized. INC is the number added to the bird's X position each time it moves a leg. The larger INC becomes the faster as the bird moves. MAX is the number of DATA statements in the program. S1 is set to 20 and represents the initial scale for the upper and lower legs, while S1 is set to 5 to represent the smaller scale of the foot (remember we are using the same vector for the legs and feet).

The program jumps to line 1000 where the vector shape table is POKEd into memory along with the starting address of the shape since we are not using SHLOAD.

Next we are sent to line 100 where the main work of the program begins with a FOR . . . NEXT loop. The loop causes six variables to be READ from the first DATA statement. Then the HCOLOR is made white and the GOSUB 50 is executed. This subroutine takes the six variables and uses each one as a rotation before drawing one of the legs. The subroutine starts with an HPLOT statement which determines where the upper leg will be drawn from (and hence the hips of the bird). Each part of the leg is drawn immediately after the one before it. Only scale and rotation are changed. The DRAW statement without an AT X,Y accomplishes this.

After leg A is drawn we draw leg B and leave the subroutine. The color is changed to black and the GOSUB 50 is used again, but this time to erase the legs. Then X is incremented and the loop repeats for the next DATA statement.

After all DATA statements have been executed and the loop is completed, statement 160 checks the X position and if it's greater than 220 the bird is far enough left to overflow the HPLOT statement when a DRAW is executed. We then reset X to zero. To make the demo interesting we also use the RND statement to generate a random scale S1 so the legs will change size. S2 is made one quarter of S1 for the foot. INC, which controls speed, is made one eighth the size of S1 so larger shapes move faster. Finally, the program jumps back to line 100 to repeat the drawing part with a new scale. Line 135 is used to put a delay in the redrawing proportional to the paddle setting so that we can manually slow down and speed up the animation.

```
0  HIMEM: 8046
1 INC = 2
2 MAX = 9
10  HGR : HCOLOR= 3:X = 140:Y = 7
0
11 S1 = 20:S2 = 5
12  GOTO 1000
50  HPLOT X,Y: SCALE= S1: ROT= R1
: DRAW 1: ROT= R2: DRAW 1: ROT=
R3: SCALE= S2: DRAW 1
55  HPLOT X,Y: SCALE= S1: ROT= R4
: DRAW 1: ROT= R5: DRAW 1: ROT=
R6: SCALE= S2: DRAW 1: RETURN

100  FOR I = 1 TO MAX
120  READ R1,R2,R3,R4,R5,R6
130  HCOLOR= 3: GOSUB 50
135  FOR D = 1 TO  PDL (0): NEXT
D
145  HCOLOR= 0: GOSUB 50
146 X = X + INC
150  NEXT I
155  RESTORE
160  IF X > 220 THEN X = 20:S1 =
 RND (1) * 50 + 10:S2 = S1 /
4: INC = S1 / 8
165  GOTO 100
200  REM
201  REM
300  REM  START OF LEG MOVEMENTS
311  DATA  32,26,16,38,30,16
312  DATA  33,26,16,42,32,18
313  DATA  33,26,16,44,33,20
314  DATA  34,27,16,45,24,18
315  DATA  34,27,16,43,22,12
316  DATA  35,28,16,38,18,13
317  DATA  35,28,16,32,15,8
318  DATA  36,29,16,30,16,12
319  DATA  36,29,16,32,20,12
998  REM
999  REM   A ONE VECTOR SHAPE
1000  POKE 232,110: POKE 233,31
1010  POKE 8046,1: POKE 8047,0: POKE
8048,4: POKE 8049,0: POKE 80
50,4: POKE 8051,0
1030  GOTO 100
```

Program A. The Bird Animation Program

Adding A Body Shape

At this point the animation can be run, but it will be a bodyless set of legs. To add a body we can define another shape in the shape table and do a DRAW 3 before drawing the legs.

PROBLEM: Add a simple body to the bird legs using a third shape in the shape table. Store the shape vectors in DATA statements. Keep the number of vectors for the body under 50 to reduce the flicker effect.

SOLUTION: Draw the body on tenth inch grid paper as shown in Figure 3. Draw the body as a series of up, down, right, or left vectors. Divide the vectors into logical subsections. Convert the body to data statements using the key for shapes (shown in Figure 3) to convert the vectors to a series of numbers 0,1,2, or 3. These represent the vector's directions.

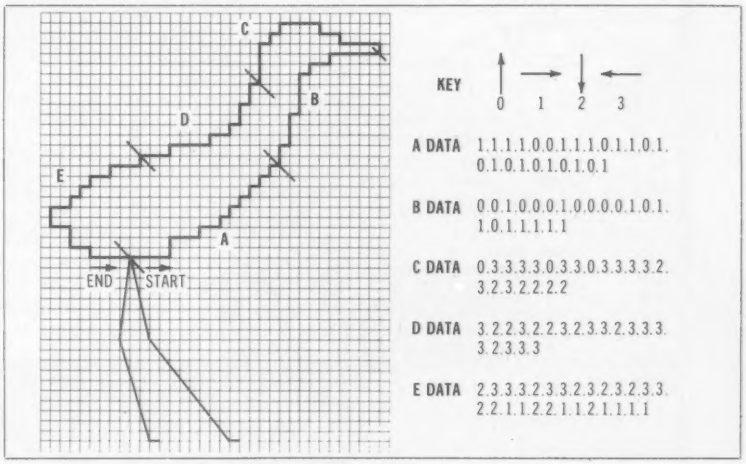


Figure 3. The body for the bird animation program is sourced in data statements.

```
KEY: 0!     DATA 5X 1,1,1,1,0,0,1,1,1,
     1–                 0,1,1,0,1,0,1,0,1,
     2!                 0,1,0,1,0,1
     3–

0,0,1,0,0,0,1,0,0,0,0,1,0,1,1,0,1,1,1,1,1
0,3,3,3,3,0,3,3,0,3,3,3,3,2,3,2,3,2,2,2,2
3,2,2,3,2,2,3,2,3,3,2,3,3,3,3,2,3,3,3
2,3,3,3,2,3,3,2,3,2,3,2,3,3,2,2,1,1,2,2,1,1
  2,1,1,1,1
```

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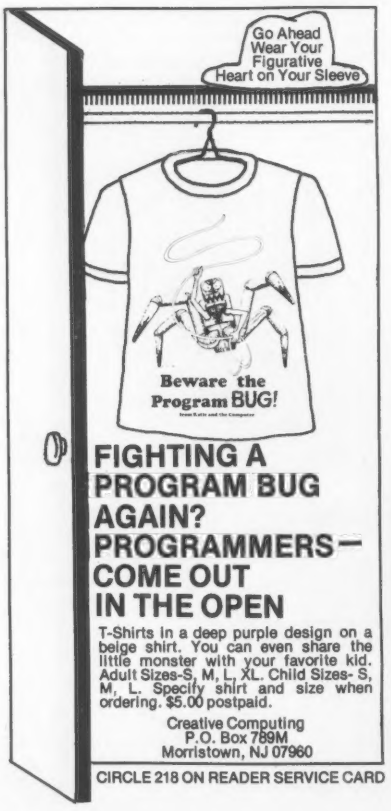
Animation, con't . . .

```
0  HIMEM: 8046
1 INC = 2
2 MAX = 9
10  HGR :X = 140:Y = 85
11 S0 = 1:S1 = 20:S2 = 5:R0 = 0
13  POKE  - 16302,0
14  GOTO 2000
50  SCALE= S1: ROT= R1: DRAW 1 AT
X,Y: ROT= R2: DRAW 1: ROT= R
3: SCALE= S2: DRAW 1: SCALE=
S1: ROT= R4: DRAW 1 AT X,Y: ROT=
R5: DRAW 1: ROT= R6: SCALE=
S2: DRAW 1
60  SCALE= S0: ROT= R0: DRAW 2 AT
X,Y: RETURN
100  RESTORE
105  FOR I = 1 TO MAX
120  READ R1,R2,R3,R4,R5,R6
130  HCOLOR= 3: GOSUB 50
135  FOR D = 1 TO  PDL (0): NEXT
D
145  HCOLOR= 0: GOSUB 50
146 X = X + INC
150  NEXT I
155  RESTORE
160  IF X < 220 THEN 100
165 S1 =  RND (1) * 40 + 10:S2 =
S1 / 4:INC = S1 / 8
170 S0 = S1 / 12: IF S0 < 1 THEN
S0 = 1
175 X = 20
180  GOTO 100
200  REM
201  REM
300  REM  START OF LEG MOVEMENTS
311  DATA  32,26,16,38,30,16
312  DATA  33,26,16,42,32,18
313  DATA  33,26,16,44,33,20
314  DATA  34,27,16,45,24,18
315  DATA  34,27,16,43,22,12
316  DATA  35,28,16,38,18,13
317  DATA  35,28,16,32,15,8
318  DATA  36,29,16,30,16,12
319  DATA  36,29,16,32,20,12
998  REM
999  REM  A ONE VECTOR SHAPE
1000  POKE 232,110: POKE 233,31
1010  POKE 8046,1: POKE 8047,0: POKE
8048,4: POKE 8049,0: POKE 80
50,4: POKE 8051,0
1030  GOTO 100
2000  REM  LEG VECTOR AND BODY
2001  REM  VECTOR STORED HERE
2005  POKE 232,110: POKE 233,31
2010  POKE 8046,2: POKE 8047,0: POKE
8048,6: POKE 8049,0: POKE 80
50,8: POKE 8051,0: POKE 8052
,4: POKE 8053,0
2015  FOR DUM = 1 TO 54: READ I: NEXT
DUM
2020  FOR LOC = 8054 TO 8191
2025  READ ASEC,BSEC
2026  IF ASEC = 9 OR BSEC = 9 THEN
2060
2030 BYTE = (BSEC * 8) + ASEC + 3
6
2035  POKE LOC,BYTE
2045  NEXT LOC
2060  POKE LOC,0: POKE LOC + 1,0:
 GOTO 100
2100  REM
2101  DATA  1,1,1,1,0,0,1,1,1,0,
1,1,0,1,0,1,0,1,0,1,0,1,0,1
2102  DATA  0,0,1,0,0,0,1,0,0,0,0
,1,0,1,1,0,1,1,1,1,1
2103  DATA  0,3,3,3,3,3,0,3,3,0,3,3
,3,3,2,3,2,3,2,2,2,2
2104  DATA  3,2,2,3,2,2,3,2,3,3,2
,3,3,3,3,2,3,3,3
2105  DATA  2,3,3,3,2,3,3,2,3,2,3
,2,3,3,2,2,1,1,2,2,1,1,2,1,1
,1,1
2106  DATA  9,9
```

Program B.



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Program B is simply an extension of the previous one. To use the full screen we do a POKE -16302,0 at line 13 and then immediately GOTO line 2000 where the shapes tables are POKEd in. As before, the leg vector is stored. The table header is different now because there are two shapes instead of one. Statement 2015 is a dummy loop that causes the DATA pointer to move past the leg movement vectors so that it points to the beginning of the DATA statements in line 2101-2106. In line 2020 a loop is begun which reads the body data, converts it to numbers and stores it in the shape table. The formula in line 2030 converts the numbers in the data statements to values for the shape table. Line 2026 checks for an end of table condition. Upon completion, we poke zero in at the end of the table, and jump to line 100 to enter the animation routine. This part of the program works as before except we add a new statement to the drawing subroutine at line 60 to draw the body shape.

The size of the body is S0, which is one twelfth the size of S1. Figure 4 shows a typical walk of the bird across the screen.

Further Animations

We don't need to limit animation to walking or running. The same techniques used here could be used to animate a bird flying with flapping wings, a frog jumping or catching a fly with its tongue, a tree bending in the wind, or a person walking or running. The limits are your imagination and the number of vectors in the shape. □

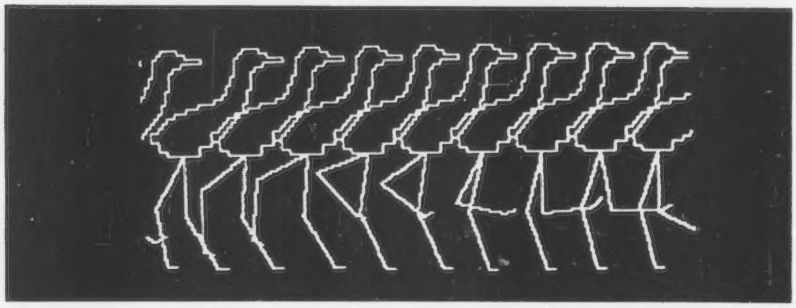

Figure 4.

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CIRCLE 131 ON READER SERVICE CARD

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EDITED BY DAVID E. SMITH
PUBLISHED BY COMPU tutor

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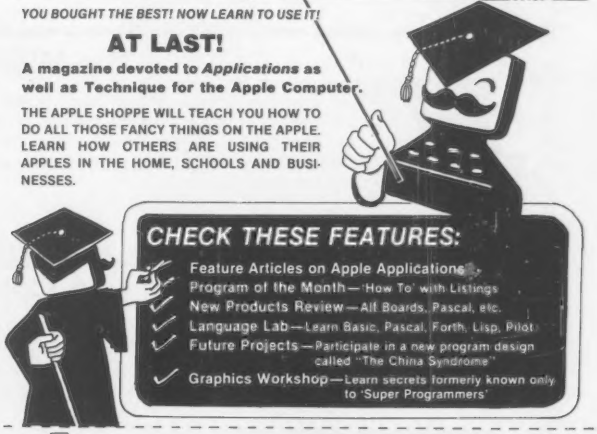

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CIRCLE 136 ON READER SERVICE CARD

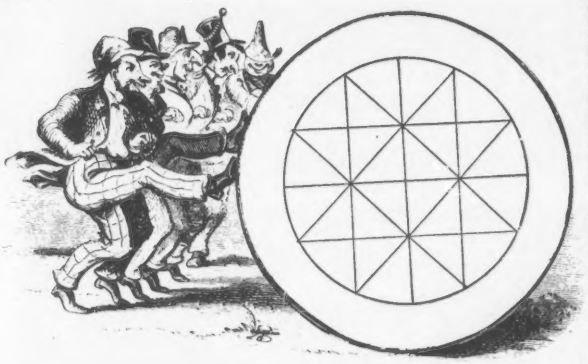
puzzles & problems

Good news from Merlin! He left a note on my desk announcing the publication of "Merlin's Puzzler 3". Like the first two volumes it is a big 8½" x 11" book running to 128 pages of the finest material dealing with puzzles, games and magic. Do the old boy a favor and ask for it at your local bookstore, or, watch for an ad in Creative Computing.

The latest solutions to the ongoing saga of the puzzle known as "The Old Soup and Fish" come from five of our readers. The challenge put to the reader in the August 1979 issue of Creative Computing was to change the word "Soup" into the word "Fish" in six moves. During each move the puzzler had to change one letter in the word so that a new word was formed. The following solution was sent in by Stuart Ginn of St. Petersburg, Fla., James Spencer of Binghamton, N.Y.. Bill Mooney of Old Bridge, N.J., Wayne L. Maude of Torrington, Wy., and Mark Kantrowitz, Brookline, Mass. To each one goes a copy of "Merlin's Puzzler". Their answer was; SOUP, LOUP, LOUT, LOST, LIST, FIST, FISH. Does anyone care to try for five moves?

The Flatland Puzzle

During the puzzle convention held on Merlin's Isle this summer a group of lads from one of the local puzzle clubs rolled a drum up to the judges' platform. Pointed on the end of the drum was a puzzle in flatland design. The puzzle was to discern how many continuous strokes were needed to draw this design. (Drawing a circle, or part of a circle, in one direction is counted as one line). Try using this pencil and paper. You may not left your pencil from the paper while drawing it. Every time your pencil changes direction it is to be considered a new stroke. You will have to draw over the same line more than once to solve it. What are the smallest number of strokes needed to duplicate the design? (This puzzle is from "Merlin's Puzzler 3")



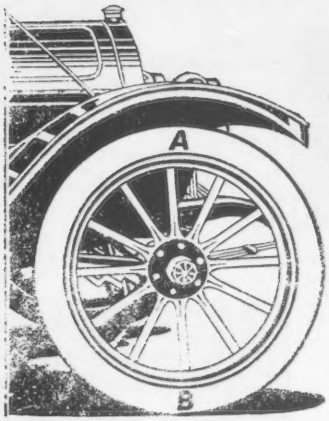
The Missing Number Problem

Here is an interesting question from Mr. James Spencer of Binghamton, N.Y. The problem is short, but tricky. You are to figure out what the missing number should be in the sequence of numbers printed below. (Since Mr. Spencer has already earned a copy of "Merlin's Puzzler" for his solution to "The Old Soup and Fish" we are sending along to him a copy of our new children's book of puzzles called "The Club Club." Your lucky day Mr. Spencer!)

A Colorful Question

The following colorful problem should prove interesting. Do not leap to the obvious answer. Below are pictured four cards face-up on a table. One side of each card is either Red or Green. The other side of each card has either a square or a circle printed on it. What are the fewest number of cards that you have to turn over, and what are their numbers, to answer the question; Does every Red-backed card have a square printed on the other side?

Answers on page 192.



The Famous Paradox

This puzzle deals with the question, when a car is in motion, does the upper part of each wheel move faster than the bottom part of each wheel near the ground? Since a wheel is a solid object, that revolves around a center point, any two points on the wheel, each of which is the same distance from the center, must move at the same rate of speed. If, in fact, both points move at the same rate of speed then they should cover the same distance during a given period of time.

"This is all very true," said a friend of Merlin, "but how do you explain the fact that when you look at the wheel of a passing car the spokes in the upper half of the wheel seem to be blurred while the spokes in the bottom half can clearly be seen and even counted if the car is moving slowly enough. (There are a lot of old cars on Merlin's Island). Is this an optical illusion or is the top half of the wheel really moving faster than the bottom half?

Well, puzzlers, what do you think? Do points **A** and **B,** on the tire pictured here, travel at the same rate of speed, or, does one of them travel faster than the other? (This puzzle is from "Merlin's Puzzler 3").

A Pair of Pretty Problems

We have here two problems from Mr. Kenneth Meyer of Oxnard, Ca. A copy of "Merlin's Puzzler" is on the way!

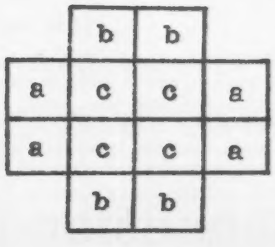
You are heading from Bradbury Junction to Andersonville, when you come to a fork in the road. You do not know which fork of the road to take.

Problem 1: In this version, nobody is there, but the signpost, which should be pointing the way, is laying on the ground near the hole it once was in. You put it in the hole, but that doesn't tell you which of the arms should point down which road. How do you orient the signpost properly?

Problem 2: In this version, there is no signpost, but there is a person there. (To solve this problem, you must assume that robots always lie, and humans always tell the truth. However, there is no other way to tell the difference between humans and robots. This is rather like R. Daneel Olivaw in Asimov's The Caves of Steel). You can't tell whether he is a robot, so you can't tell whether he will tell the truth or lie. It is possible to ask the person one question that will tell you which is the right road, whether he is a robot or a man. What is the question?

The "Twenty-Six" Puzzle

This is a magic square with a difference, the four corner places being omitted. The problem is to arrange the numbers 1 to 12 inclusive in the form of a cross, as shown in Fig. 1, so as to make 26 in seven different ways - viz., the two horizontal and the two vertical rows, the group of squares marked aaaa, the group marked bbbb, and group marked cccc, each making the above-mentioned total. (From Merlin's Puzzler).



Do you have a favorite puzzle that you would like to stump our readers with? If so, then send it along, and, if Merlin uses it he will send you a copy of one of his books.

Your Editor,

Charles Barry Townsend

APPLE II

Haunted House, CS-4005 (16K)

HAUNTED HOUSE
YOU ARE IN THE PLAY ROOM
YOU BRUSH A LARGE SPIDER OFF YOUR ARM, WHICH DESCENDED FROM THE CEILING
AT THE END OF THE ROOM IS A DOOR
BEHIND YOU IS A DOOR

It is 6:00 and you have until midnight to find the secret passageway out of a haunted house. During your search, you may find skeleton keys to open locked doors, good luck charms, friendly ghosts, evil spirits, and skeletons. The sound effects (creaking doors and stairs) add to the eeriness. The house layout changes in every game.

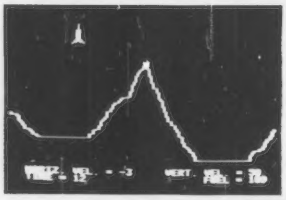
Space Games-1, CS-4001 (16K)

1. Saucer Invasion

We're being invaded by aliens from another planet. Your mission is to destroy as many saucers as possible with 15 missiles. Use the game paddle to move the launch tube back and forth across the bottom of the screen, then fire with the paddle button. A two stage missile boosts slowly, firing its warhead midway toward the target. The flying saucers fly at different speeds and altitudes, so luck and timing are crucial! High resolution graphics, exploding saucers and wild sound effects make full use of the APPLE capabilities.

2. Rocket Pilot

Rocket Pilot is an advanced real time take off and landing game. The object is to maneuver your spaceship successfully



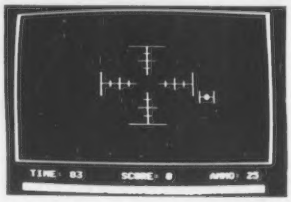
over a mountain to the landing area on the other side. The game paddles control your horizontal and vertical thrusters. In addition to the graphics display of the rocket, the screen also shows your current velocity, time, and remaining fuel. Earn a rating of "rocket pilot" if you negotiate the trip without running out of fuel or crashing into the mountain.

3. Dynamic Bouncer

Watch a ball move through a maze of colorful, changing obstacles in this creative graphics demonstration.

4. Star Wars

Use the game paddles to get the enemy TIE fighters within your crosshairs, then FIRE!! The object is to destroy as many enemy ships as possible in 90 seconds as they perform evasive maneuvers to avoid your fire.



Lasers, exploding enemy fighters, and action sounds put you in the middle of the fierce battle against the Imperial Empire!

Apple Software on Disks

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SPACE AND SPORTS GAMES CS-4501

- Rocket Pilot
- Saucer Invasion
- Star Wars
- Dynamic Bouncer
- Baseball
- Torpedo Alley
- Slalom
- Darts

STRATEGY AND BRAIN GAMES CS-4502

- Checkers
- Skunk
- UFO
- Blockade
- Genius
- Nuclear Reaction
- Dodgem
- Dueling Digits
- Parrot
- Midpoints
- Lines
- Tones

CAI PROGRAMS AND KNOW YOURSELF CS-4503

- U.S. Map
- Spelling
- Math Drill
- Add-With-Carry
- Life Expectancy
- Psychotherapy
- Computer Literacy
- Alcohol
- Sex Role

How To Order

Creative Computing Software should be stocked by your local retail computer store. If your favorite outlet does not have the software you need, have him call our retail marketing dept. at 800-631-8112. (In NJ, 201-540-0445).

Or you can order directly from Creative Computing. Use the handy order form on page 139.

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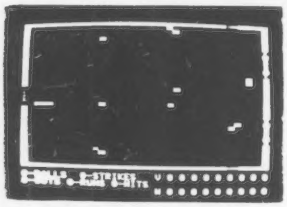
Sports Games-1, CS-4002 (16K)

1. Baseball

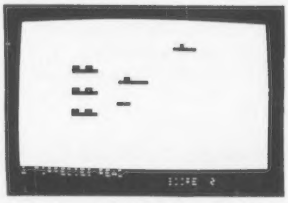
Play in the APPLE World Series! This two-player game is played according to Major League rules. Game paddles control the infielders and outfielders, as you pitch changeups, fastballs, sliders, curves or knuckleballs. When you're at bat, good timing is the key as you swing the bat with a



tap on the space bar. This exciting graphics game even includes stealing, double plays, and sacrifices under computer control.

2. Torpedo Alley

The object of Torpedo Alley is to sink as many ships as possible with your forward torpedo tubes. Move into position and FIRE!! But don't waste a shot—it takes time to reload when the tubes are empty. Targets include aircraft



carriers, patrol boats, destroyers, and cargo ships. Depending on your score, you earn the rank of cook, seaman, or captain. How many stripes for you?

3. Slalom

Have fun skiing without getting cold! Slalom is a downhill exercise in which you weave in and out of the flags on a championship slalom course. Game paddles control the speed and motion of the skier as you go for Olympic gold. But don't knock down any flags or go off the mountain. Swiss hospitals don't take Master Charge!

4. Darts

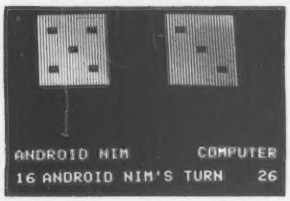
How's your aim? Play darts and find out. You have six darts to throw at a dartboard. The game paddles control the position of the darts. Can you hit the Bullseye?

Strategy Games-1, CS-4003 (16K)

1. Checkers

(Requires Applesoft or Applesoft II BASIC)

This is the APPLE version of the popular board game, with color graphics. Test your strategy against the computer. The computer does not look ahead for future moves, hence it is best suited for beginning players.

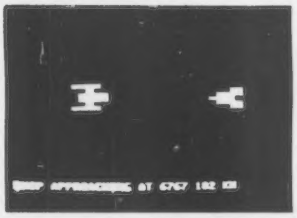


2. Skunk

Skunk is a two player dice game in which the object is to accumulate 100 points before your opponent. On each turn you may roll the dice or "pass." You roll the dice by turning a game paddle, and the value of the roll is added to your total score. If you roll a 1, you lose all the points accumulated on that turn. If you roll snake eyes (two 1's), your total score goes to 0.

3. UFO

You are the captain of a space ship carrying the last remnants of the human race, after a space war with another planet in which both worlds were destroyed. The aliens have launched a similar vessel and will attempt to



destroy your ship. On each move you decide whether to maneuver, halt for repairs, or fire from your arsenal of heavy guns, warheads and lasers.

4. Blockade

In this game, each player controls a colored marker which leaves a trailing path. The object is to keep your marker in motion longer than your opponent by not running into a wall, the other player's path, or crossing your own path. Direction is controlled on the keyboard, but you can't stop moving. Game options include one or two player games, and accelerated speeds which increase as the game progresses.

5. Genius

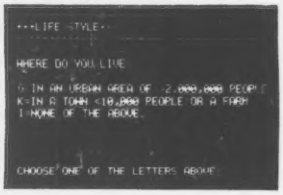
In each round of this game, you are given a potpouri of 5 trivia questions to answer as quickly as possible. Any final score above 400 will merit a rating of genius, but watch out! There's a 25 point penalty for each wrong answer. The quiz includes questions about movies, sports, TV, literature, general knowledge, and of course, computers.

Know Yourself, CS-4301 (16K)

The programs in this series aren't games, but they are fun to use. All of them are based on statistically valid tests and data. Using them from time to time could help you see in what direction your life is progressing.

1. Life Expectancy

Do you ever wonder how long you will live? Take the Life Expectancy quiz and find out! Will a different life style increase



your life expectancy? Will following all the advice in the National Enquirer really help?

2. Psychotherapy

The APPLE analyst asks you 20 questions to help you decide if you might benefit from a psychotherapist. Psychotherapy asks you about your feelings, actions, and phobias and compares them against population norms. Here's where you can talk freely about those special powers people are using against you. With sound. For all computer freaks.

3. Computer Literacy

Are you a computer whiz? Try this quiz and find out how much you know about computers and computing. On each round, answer 5 questions as quickly as possible. Depending on your score, you will be rated from janitor to a systems analyst. Questions range from history to present technology and applications. A large number of questions ensures variety on each round.

4. Alcohol

Are you a lush? Do you like to hide your Ripple in a Grape Nehi bottle? Alcohol allows you to experiment with the relationship between drinking, the alcohol level in your blood, and its effects on your behavior. Enter parameters such as body weight, time spent drinking,

type of beverage and number of drinks. Sound and graphics—even a bubbling champagne glass!—make Alcohol fun as well as informative.

5. Sex Role

Are you androgynous? This program helps you to examine your nature, behavior and attitudes in light of society's changing concept of sex roles.

CAI Programs, CS-4201 (16K)

1. U.S. Map

Do you have problems remembering which state is which? Do you know the capitals? After a few games of U.S. Map, you should have no trouble. This advanced application of APPLE high resolution graphics enhances interest in the learning process. Options allow you to choose whether to identify only the state or both the state and its capital. As the run progresses, missed states or capitals are repeated several times.

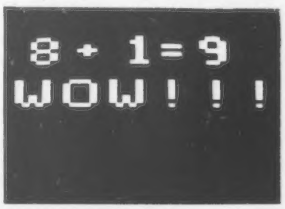
2. Spelling

(Requires Applesoft or Applesoft II BASIC)

Do you need practice spelling? Let APPLE's Spelling program lend a hand. You are shown a word and asked to spell it when it disappears. Grades from A+ to F are given depending on how many you get correct. The better you are, the shorter the time you see the hint word.

3. Math Drill

How are your math skills? Let Math Drill help you improve them. You can choose the type of problem you wish to



practice—addition, subtraction, multiplication, division or mixed. You may also choose large or small numbers, whether or not to have a time limit, and how long the limit is to be.

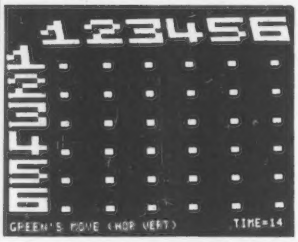
4. Add With Carry

Here is a program to help you with harder addition. You are presented with a series of addition problems of increasing difficulty. You add one column at a time, filling in the column sum and then the carry amount. If you do well, the problems get harder, if you don't, they get a little easier.

CIRCLE 217 ON READER SERVICE CARD

APPLE II

Brain Games-1, CS-4004 (16K)



1. Nuclear Reaction

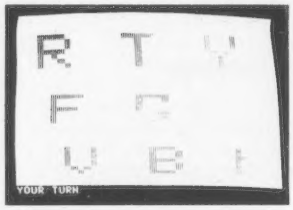
Nuclear Reaction is an exciting strategy game for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending a particle to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reaction to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours. Action sound effects.

2. Dodgem

In Dodgem, two sets of pieces move at right angles across a checker style board. The object is to move all your pieces across the board and off the opposite edge. One player moves from the bottom to the top while the other moves left to right. You may play Dodgem against the APPLE or a friend. Six board sizes and action sound effects.

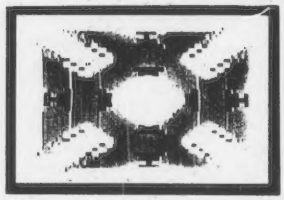
3. Dueling Digits

Do you have a good memory for sequences of numbers? Play Dueling Digits and find out. In this game, the computer presents a digit and tone, then erases it. You then type in the same digit. After each turn, the computer repeats all the previous digits and adds a new one, and you try to type in the entire sequence. The round is over when you make four mistakes. For up to four players. Two skill levels.



4. Parrot

Parrot is similar to Dueling Digits, but you try to remember sequences of letters and tones instead. Two skill levels.



5. Midpoints and Lines

These two colorful graphics demonstrations will run continuously. Great for store displays, parties, and showing off your computer.

6. Tones

This program allows you to make your own music and sound effects with the game paddles. One paddle controls the pitch of the tone, the other controls the duration. No special hardware is required.

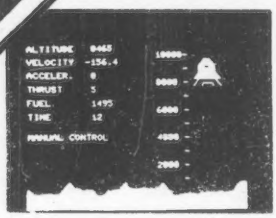
SORCERER

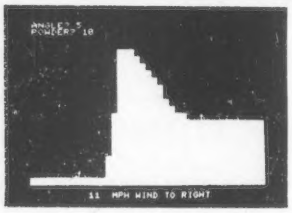
Smart Alec, CS-5002 (8K)

Smart Alec is fun as well as educational. Test your memory by answering five multiple-choice questions on each round. Each question has a time limit and you are penalized 25 points for a wrong answer. Your score is based on how long it takes you to get the correct answer. If you do well, the computer will certify you as a genius.

There are seven areas in which to test your expertise. They are:
1. Science
2. Geography
3. History
4. Computers
5. T.V. and Movies
6. English
7. Trivia

Graphics Games-2, CS-5001 (8K)





1. LEM

In this graphic version of the popular real time lunar landing game you must land on the moon's surface with the lowest possible velocity. You can control the thrust of your retro-rockets with the number keys but you have a limited amount of fuel. The automatic pilot option can be activated and deactivated with the keyboard. You take a walk on the moon and plant a flag if you land successfully.

2. Pie Lob

This is a game in which two players lob pies at each other across a computer-generated hill. You choose the angle and the strength of the throw and then watch the trajectory of the lob across the screen. The computer changes the terrain and the wind speed in each game. Pie Lob makes good use of SORCERER's graphics.

3. Nuclear Reaction

Nuclear Reaction is an exciting strategy games for two players. Each player, in turn, places a particle of radioactive material on a 6x6 board. When the number of particles at a location reaches its critical mass, it explodes, sending particles to adjacent squares. As the board fills up, a single explosion can cause long chain reactions. The object of the game is to cause the right chain reactions to wipe out all your opponent's pieces. Nuclear Reaction is a game of skill, fast decisions, and quick reversals, making it fun to play for many hours.

4. Bounce

Bounce is an intriguing graphics demonstration which traces the path of a ball as it bounces around the screen.

5. Checkers

The SORCERER matches its strategy against yours in this popular game. The computer does not look more than one move ahead, hence the game is best suited for beginning players.

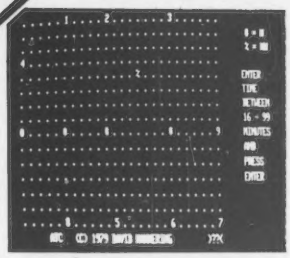
6. Dodgem

Dodgem is played on a checker-type board against the computer or another player. The object of the game is to block your opponent to slow him down. One player moves pieces from the bottom of the board to the top, and the other player moves from left to right, trying to get all the pieces off the board. This is a challenging game of strategy.

CIRCLE 217 ON READER SERVICE CARD

TRS-80 LEVEL II

Air Traffic Controller, CS-3006 (16K)

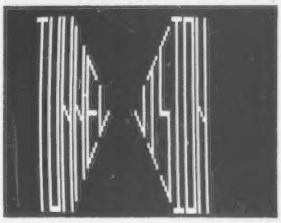


This real time machine language program puts you in the chair of an air traffic controller. There are 27 airplanes—jets and prop planes—which must be controlled as they land, take off and fly over your air space. You give the orders to change altitude, turn, maintain a holding pattern, clear for approach, and land at your two airports. This realistic simulation includes navigational beacons, and requires planes to take off and land into the wind. Air Traffic Controller was written by an air traffic controller and is a favorite of the Creative Computing staff!

Strategy Games, CS-3005 (16K)

1. Tunnel Vision

Tunnel Vision gives an exciting visual twist to the popular maze game. You are transported into a massive labyrinth and must find the exit or be lost forever. A mouse's eye view is displayed as you wander through the maze, seeing walls, turn-offs, and dead ends as they are encountered. This is an excellent example of three dimensional perspective using TRS-80 graphics.



2. Evasion

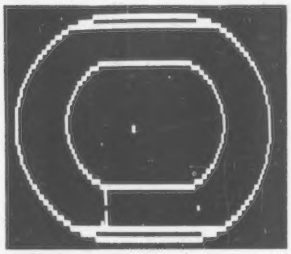
In this real time game, you are pursued around the game board by an evil-looking snake. The arrow keys control your small drone as it tries to avoid being bitten for as long as possible. (Evil-looking snakes always catch their drones.) Variations of play include two different speeds and hyper-jumps which randomly relocate you on the board. Looking for an escape? Try Evasion.

3. Jigsaw

Jigsaw is a computer-age puzzle game making extensive use of TRS-80 graphics. The computer generates a random puzzle and puzzle board. Using a combination of deductive reasoning and luck you must fit the graphically represented puzzle piece into place. Jigsaw has four different options featuring concealed pieces and helpful clues.

4. The Masters

Are you a wandering pro or just a Sunday golfer who would like to keep in practice? Each hole is graphically depicted from tee to green. You choose a club for your next stroke—wood, iron, or sand wedge. Once you're on the green, a worm's-eye view is displayed for putting.



5. Motor Racing

Motor Racing combines real time racing action with advanced graphics functions. You racing car may be driven on two skill levels. The first allows only for directional control on a simple track, while the second skill level offers a choice of professional tracks, the Indianapolis Speed Way or a road race course. The graphics and animation make Motor Racing fun to watch as well as play.

Board Games-1, CS-3001 (16K)

1. Mugwump

Mugwump is a board games which uses a 10x10 grid on which four friendly Mugwumps are hiding. Your mission is to locate these mysterious animals and capture them. You input X and Y coordinates for each move and after each round the distances from each mugwump are displayed. What is a mugwump? No one really seems to know, but if you find one, maybe you'll let us in on the secret.

2. Flip Disc

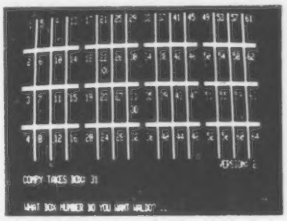
Are you an Othello freak? Do you wish there were someone who would provide you with a challenging game at a moment's notice? Flip Disc is a program which will turn your computer into an excellent opponent. Flip Disc provides the game board, chips, and handles all playing functions. Three different skill levels, (good, expert, and genius), provide an introduction for the novice and continuing interest for the experienced player.

3. Wumpus

Chances are if you ever leave your keyboard you have heard of the mythological Wumpus. In the game of Wumpus 1, you are scouring a network of underground caves in search of the prized Wumpus. The dreaded super bats and bottomless pits make Wumpus hunting a risky affair. On each turn, as you wind your way through the caves, you have a choice of moving or shooting through the cave. Bagging a Wumpus wins the game, but if you accidentally stumble into his cave, the Wumpus will enjoy a tasty dinner of sauteed computer freak.

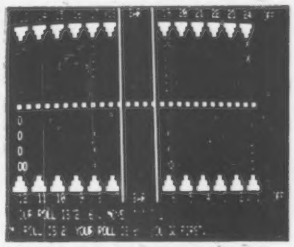
4. Wumpus 2

If you master the dodecahedron cave network in Wumpus 1, you may proceed to Wumpus 2 which allows you to choose from five different caves, or you can design your own. Super bats and the infamous bottomless pits are also included in Wumpus 2, so be prepared to jump into the frying pan!



5. Qubic

Qubic is a three dimensional Tic Tac Toe game. The game is played in a 3 dimensional cube (4x4x4). The object is to outwit the computer and place four pieces in any straight line. Be warned, the computer plays a very tough game and makes no concessions for your ability, or lack of it.



6. Backgammon

This is the TRS-80 adaptation of the popular board game. Backgammon uses graphics and all the standard backgammon rules, not a strange computer variation. The computer is your opponent in this version, written by Scott Adams of "Adventure" fame.

How To Order

Creative Computing Software should be stocked by your local retail computer store. If your favorite outlet does not have the software you need, have him call our retail marketing dept. at 800-631-8112. (In NJ, 201-540-0445).

Or you can order directly from Creative Computing. Use the handy order form on page 139.

sensational software

creative computing software

CIRCLE 217 ON READER SERVICE CARD

TRS-80 LEVEL II

Investment Analysis, CS-3305 (4K)

This program was originally developed for personal use by an investment specialist. Creative Computing Software now makes this package available for you to analyze your investments and investment decisions. Programs in this package include regression analysis, stock market simulations, market/stock values, risk analysis, time related investments, and tax analysis. (Available in October)

Checking Account, CS-3304 (16K)

This program does not replace the standard method of checkbook balancing. Instead it acts as an aid in keeping track

SEARCH COMMANDS:
1 = # BY DATE
2 = # BY PAYEE
3 = # BY CHECK NO.
4 = # TOTAL LIST
COMMAND? 4
CHECK DATE PAYEE AMOUNT
144 05-05-79 MIKE MURPHY $121.51
188 05-21-79 RALPH WALDO EMERSON $121.00
123 05-21-79 AMOS MCKINNEY $1.75
TOTAL $244.26
PRESS ENTER TO CONTINUE? _

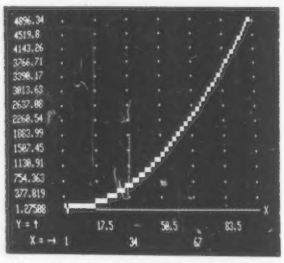
of individual and monthly expenses. You enter the amounts and payees of individual checks, and save the information on cassette tape. The program then allows you to analyze your checks by payee or date of payment. Keep track of where your money is going and how effective your budget is.

Graphic Package, CS-3301 (16K)

This package provides a variety of interesting and useful graphing routines. Graphing Package combines text and TRS-80 graphics to plot a variety of functions and other graphs.

1. Bar Graph

Bar Graph plots graphs for up to six different categories. An optional display does conversion to a line graph.

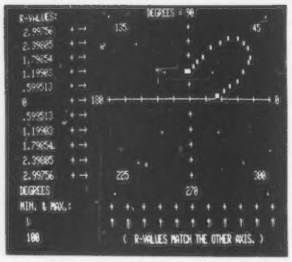


2. Cartesian Coordinate Graphing

This program plots a standard X, Y graph from a user entered function. A special feature of this program automatically scales of the Y-axis.

3. Polar Coordinate Graphing

Rarely found in computer graphing packages, this polar



graphing program provides plots of polar functions. The program labels all axes, features automatic scaling, and lets you input the range and increment of the plot. A unique and valuable program.

4. Parametric Graphing

Parametric functions are functions in which both x and y are expressed in terms of an independent variable t. The resulting graph is X vs. Y. This program allows the user to input two parametric functions and produces a graph.

5. Linear and Parabolic Regression

These two programs are used for data analysis which can later be entered into the graphing routines. Regression routines analyze how well a series of points fit on a linear or quadratic function.

Tape Manager and Advanced Statistics, CS-3303 (16K)

This package may be the ultimate in statistical applications for the 16K TRS-80. Attractively packaged in a vinyl binder with a large instruction booklet, Advanced Statistics will provide you with the ability to perform statistical tests never before available on small computers. Its cassette based data file system allows you to store, retrieve, and transform data files for use in several different tests.

1. Tape Manager

Tape Manager, the heart of the statistical file management, allows you to create, edit, and transform data files. Unique to this program are features that allow the user to perform transformations on variables, extract and create subfiles, and selectively copy records. Up to twenty variables and an unlimited number of cases can be processed.

2. Descriptive Statistics

Descriptive Statistics computes the mean, standard deviation, standard error of estimate, variance, skewness, kurtosis, range, median, and quartiles for a variable and constructs a histogram for each value. A test scoring option for conversion of raw scores into percentiles is included.

3. Two Variable Statistics

This program calculates descriptive statistics for each variable. It performs a t-test for the difference of means, computing the product-moment correlation coefficient and its associated significance level. In addition, it performs linear regression and computes standard error of estimate for Y.

4. Crosstabulation

This program constructs contingency tables for displaying frequencies, column percentages and table-wide percentages for each cell. It computes the Chi-square, the level of significance and gamma statistics. Tables as large as 10x10 may be evaluated.

5. Regression-Trend Analysis

This program computes least-squares regression coefficients from time-series or paired data for best-fit equations (linear, parabolic, hyperbolic, logarithmic, power, exponential and cubic types). Calculates standard error of estimate for each equation and more.

6. Multiple Linear Regression

Performs multiple linear regression using up to ten independent variables. The program computes both unstandardized and normalized coefficients, covariance, multiple correlation coefficient, and the standard error of estimate.

STANDARD CORRELATION COEFFICIENTS
VARIABLES COVARIANCE CORRELATION SIGNIFICANCE: PC
1 2 .61373 .81348 .02
1 3 .58891 .767485 .05
1 4 .19753 .44444 N.S.
2 3 .784867 .829867 .01
2 4 .288896 .536746 N.S.
3 4 .637969 .79873 .02
6 DEGREES OF FREEDOM
PRESS ENTER TO CONTINUE? _

7. Correlation Analysis

Computes product-moment correlation matrices, multiple correlation coefficients and partial correlation coefficients with their associated significance levels.

8. Analysis of Variance

This program performs one-way and two-way analysis of variance for a maximum of ten groups in each control variable. Statistics include the mean and standard deviation for each group, sum of the squares, degrees of freedom, mean square, F-ratios, and significance level.

CIRCLE 217 ON READER SERVICE CARD

Economic and Ecology Simulations

The Ecology Simulations series are a unique educational tool. They are based on "simulation models" developed by the Huntington Two Computer Project at the State University of New York at Stony Brook under the direction of Dr. Ludwig Braun. The programs and accompanying documentation are written for self-teaching or classroom use and include background material, sample exercises and study guides. Graphic displays were specially developed by Jo Ann Comito at SUNY and Ann Corrigan at Creative Computing. The Ecology Simulations packages are a remarkable educational application of micro-computers.

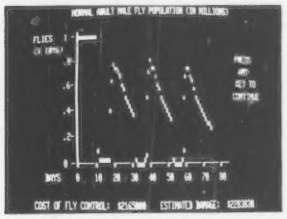
Ecology Simulations-1, CS-3201 (16K)

1. Pop

The POP series of models examines three different methods of population projection, including exponential, S-shaped or logistical, and logistical with low density effects. At the same time the programs introduce the concept of successive refinement of a model, since each POP model adds more details than the previous one.

2. Sterl

STERL allows you to investigate the effectiveness of two different methods of pest control—the use of pesticides and the release of sterile males into the fly population. The concept of a more environmentally sound approach versus traditional chemical methods is introduced. In addition, STERL demonstrates the effectiveness of an integrated approach over either alternative by itself.



3. Tag

TAG simulates the tagging and recovery method that is used by scientists to estimate animal populations. You attempt to estimate the bass population in a warm-water, bass-bluegill farm pond. Tagged fish are released in the pond and samples are recovered at timed intervals. By presenting a detailed simulation of real sampling by "tagging and recovery," TAG helps you to understand this process.

4. Buffalo

BUFFALO simulates the yearly cycle of buffalo population growth and decline, and allows you to investigate the effects of different herd management policies. Simulations such as BUFFALO allow you to explore "What if" questions and experiment with approaches that might be disastrous in real life.

IQ Test, CS-3203 (16K)

IQ tests have been the subject of a great deal of controversy in the past few years. Yet, few of us know our IQ score. Now you can find out with our IQ test.

Taking advantage of the TRS-80's graphic capabilities, this test consists of 60 multiple choice questions. A special machine language routine does the scoring of the test and makes cheating almost impossible.

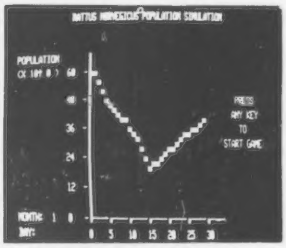
Ecology Simulations-2, CS-3202 (16K)

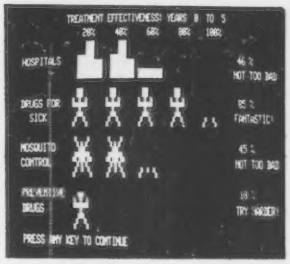
1. Pollute

POLLUTE focuses on one part of the water pollution problem; the accumulation of certain waste materials in waterways and their effect on dissolved oxygen levels in the water. You can use the computer to investigate the effects of different variables such as the body of water, temperature, and the rate of dumping waste material. Various types of primary and secondary waste treatment, as well as the impact of scientific and economic decisions can be examined.

2. Rats

In RATS, you play the role of a Health Department official devising an effective, practical plant to control rats. The plan may combine the use of sanitation and slow kill and quick kill poisons to eliminate a rat population. It is also possible to change the initial population size, growth rate, and whether the simulation will take place in an apartment building or an entire city.





3. Malaria

With MALARIA, you are a Health Official trying to control a malaria epidemic while taking into account financial considerations in setting up a program. The budgeted use of field hospitals, drugs for the ill, three types of pesticides, and preventative medication, must be properly combined for an effective control program.

4. Diet

DIET is designed to explore the effect of four basic substances, protein, lipids, calories and carbohydrates, on your diet. You enter a list of the types and amounts of food eaten in a typical day, as well as your age, weight, sex, health and a physical activity factor. DIET is particularly valuable in indicating how a diet can be changed to raise or lower body weights and provide proper nutrition.

Social and Economic Simulations CS-3204 (16K)

1. Limits

LIMITS is a micro-computer version of the well known "Limits to Growth" project done at MIT. It contains a model of the world that is built of five subsystems (population, pollution, food supply, industrial output, and resource usage) linked together by six variables: birth rate, death rate, pollution generation, resource usage rate, industrial output growth rate, and food production rate.

2. Market

Market allows two or more people to play the roles of companies who are competing for the market for a particular product: in this case, bicycles.

Each player makes marketing decisions quarterly including the production level, the advertising budget, and the unit price of the product for his/her company.

3. USPop

USPOP allows the user to study many aspects of the United States' human demography (population change) including population growth, age and sex distribution. USPOP makes population projections and investigates the consequences of many different demographic changes. (Available in November).

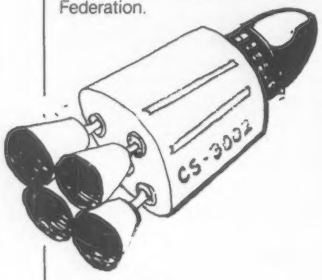
CIRCLE 217 ON READER SERVICE CARD

TRS-80 LEVEL II

Space Games-3, CS-3002 (16K)

1. Ultra-Trek

Ultra-Trek is a fast-paced version of Star Trek, complete with "real time" action graphics, lasers, Nilon space mines, high energy photon torpedoes, enemy ships that move, and an experimental ray which does something different each time you use it. At the beginning of your mission, you are told the number of Klingon base ships and battle cruisers you must defeat. Klingons have sharp eyes and quick torpedo launchers. They don't wait for you to type in your moves, so you must act quickly to save yourself and the Federation.



2. Romulan

Your mission is to destroy an invading Romulan space craft, but you'll have to find it first. The Romulans have a new cloaking device. By activating your sensors, the Romulan's position will be shown briefly, but the sensors use a lot of energy. Maneuver through space and around stars looking for the deadly enemy, but be careful! The nasty Romulans fire back.

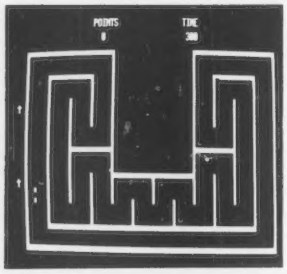
3. Star Wars

If you hate Darth Vader, you'll love Star Wars. Take an X-Wing fighter into combat and save the Rebels' base camp. Using the keyboard to control the ship, you must line up the TIE fighters into your sights and zap them with your lasers. This real time game is fun for aliens of all ages. May the Force be with you!

4. Star Lanes

Imagine yourself the president of an intergalactic shipping company. In Star Lanes you control sections of the galaxy and, on each turn, are given chances to buy stock in developing businesses. You are free to roam about the galaxy and engage in bartering, business ventures, stock splits, and company takeovers. If you're successful, you may be named Imperial Advisor on Economic Affairs. Entrepreneurs: to your ships.

Pursuit Games, CS-3004 (16K)



1. Stock Car Race

Stock Car Race is a real time racing game on a road race circuit. Your high speed racer is controlled by the "arrow" keys, as you shift up and down through four gears. Take the turns slowly, "floor it" on the straights, but don't blow your engine!

2. Maze

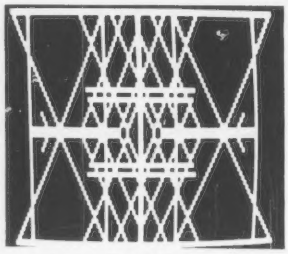
Maze for the Level II 16K machine is a high speed pursuit game. You are timed throughout your run and rated on the basis of elapsed time and the number of moves required to escape. A different maze every time. Nine skill levels.

3. Indy Racer

Indy Racer is a real time racing game for the TRS-80. You're in the driver's seat of a red-hot Indy car, changing gears and weaving around the track as you pass your competitors. Indy Racer is similar to the popular arcade-style driving games.

4. Depth Charge

As commander of a destroyer, your mission is to destroy as many enemy subs as possible. Move your ship back and forth on the water, positioning yourself over enemy subs as they cruise into range. Depth charges sink slowly, so timing and position are important in this re-creation of the Battle of the Atlantic.

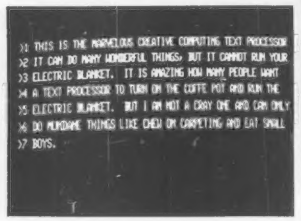


5. Kaleidoscope

This graphics demonstration program turns your TRS-80 into a computer age kaleidoscope. You enter the number of lines and size of the display to produce changing patterns on the video monitor. Truly hypnotizing, Kaleidoscope runs continuously to brighten up your home or office.

Text Processing, CS-3302 (16K)

This program turns a 16K, TRS-80 and lineprinter into a line oriented text-processing system.


)1 THIS IS THE MARVELOUS CREATIVE COMPUTING TEXT PROCESSOR
)2 IT CAN DO MANY WONDERFUL THINGS, BUT IT CANNOT RUN YOUR
)3 ELECTRIC BLANKET. IT IS AMAZING HOW MANY PEOPLE WANT
)4 A TEXT PROCESSOR TO TURN ON THE COFFE POT AND RUN THE
)5 ELECTRIC BLANKET. BUT I AM NOT A CRAY ONE AND CAN ONLY
)6 DO MUNDANE THINGS LIKE CHEW ON CARPETING AND EAT SMALL
)7 BOYS.

Developed exclusively for the TRS-80, this program lets you use the computer to enter general text or business letters, edit and modify your work, save text on cassette tapes, and print out a perfect report, document, or letter every time.

Editing commands are similar to those used in Level II BASIC, so there are no complicated new commands to learn. Lines may be either inserted or deleted. A special format is available to speed entry of business letters. Final printout can be done in numbered pages and you may print multiple copies.

TRS-80 Software on Disks, (32K)

Now, Creative Computing offers its cassette software on floppy disks. These are not just the same programs simply stored on a disk, but enhanced, menu driven libraries for the ultimate in ease of use. Machine language routines have been relocated to be compatible with disk basic, and the file handling, such as is used in the Checking Account program, can now be handled using your TRS-80 mini-floppy system. Make the most of your TRS-80 with Creative Computing floppy disk software.

CS-3501 ECOLOGY SIMULATIONS-1
Pop — Tag
Sterl — Buffalo

CS-3502 ECOLOGY SIMULATIONS-2
Pollute — Malaria
Rats — Diet

CS-3507 SOCIAL & ECONOMIC SIMULATIONS
Limits — USPop
Market

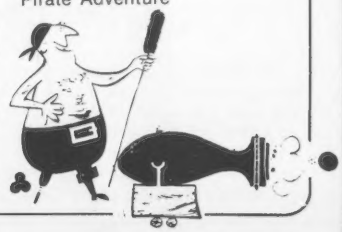
CS-3503 GAMES PACK-1

Backgammon	Stock Car Race
Qubic	Maze
Flip Disc	Indy Racer
Wumpus 1	Depth Charge
Wumpus 2	Kaleidoscope
Mugwump	Tunnel Vision
Ultra Trek	Evasion
Romulan	Jigsaw
Star Wars	The Masters
Star Lanes	Motor Racing

CS-3504 TEXT PROCESSING CHECKING ACCOUNT

CS-3505 ADVANCED STATISTICS
Data File Manager
Descriptive Statistics
Two Variable Statistics
Crosstabulation
Regression
Multiple Linear Regression
Correlation Analysis
Analysis of Variance
Advanced Multiple Regression

CS-3506 ADVENTURE 1 AND 2
Adventure
Pirate Adventure



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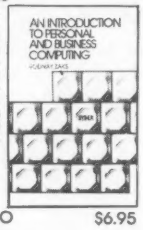

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Pascal spoken here! Well, almost. After getting the new language system running with the Installation and Operating Manual, I started reading the other system manuals. There are a total of seven of them.

- Apple Language System Installation and Operating Manual.
- Three Apple BASIC manuals - Integer, Applesoft reference, and a new one, Applesoft Tutorial. This last one includes many of the Integer BASIC programs rewritten. It uses the same refreshing style found in the Integer manual with new stuff added for Applesoft.
- Three Pascal Manuals - A text by Bowles and a Users Manual by Jensen and Wirth (recognized authorities). Also included is a **preliminary** Apple Pascal Reference Manual. A permanent manual will be available and

```
PROGRAM GRAPH1;

  USES TURTLEGRAPHICS;

  BEGIN

   INITTURTLE;
   PENCOLOR(WHITE);

    BEGIN

     MOVE(100);
     TURN(120);
     MOVE(100);
     TURN(120);
     MOVE(100);
     READLN;
     TEXTMODE;
    END;

  END.
```

Figure 1. Simple Pascal graphics program. This program will draw an equilateral triangle. The figure will be in the upper right on the screen. Turtlegraphics starts the trace in the center of the screen and draws toward the right. The turns are counterclockwise.

```
ASM

                1000 ******************
                1010 * CLOCK  ROUTINE *
                1020 * YEAR-DATE-TIME *
                1030 ******************
                1040
                1050 TIME    .EQ $C400    CLOCK PROGRAM
                1060 CHROUT  .EQ $FDED    PRNT CHAR IN A
                1070 CLOCK   .EQ $0281    CLOCK TABLE
                1080
                1090         .OR $0384
                1100
0384- A9 C4     1110 PROGRM  LDA #$C4     CLOCK TO KEYBD
0386- 85 39     1120         STA $39      KSWH
0388- 20 00 C4  1130         JSR TIME     RUN CLOCK
038B- A2 04     1140         LDX #$04     INDEX COUNT
038D- BD AC 03  1150 YEAR    LDA TABLE,X  YEAR TABLE
0390- 09 80     1160         ORA #$80     NORMAL OUT
0392- 20 ED FD  1170         JSR CHROUT   PRINT IT
0395- CA        1180         DEX          TABLE DONE ?
0396- 10 F5     1190         BPL YEAR     NO-GO BACK
0398- A9 BA     1200         LDA #$BA     COLON
039A- 8D 88 02  1210         STA $0288    SWAP IT
039D- 8D 8B 02  1220         STA $028B    SWAP IT
03A0- A2 13     1230         LDX #$13     INDEX COUNT
03A2- BD 81 02  1240 TIME1   LDA CLOCK,X  DATE & TIME
03A5- 20 ED FD  1250         JSR CHROUT   PRINT IT
03A8- CA        1260         DEX          TABLE DONE ?
03A9- 10 F7     1270         BPL TIME1    NO-GO BACK
03AB- 60        1280         RTS          END IT
03AC- 39 37 39
03AF- 31        1290 TABLE   .AS '9791'   YEAR
03B0- 8D        1300         .HS 8D       CARRGE RET
                1310         .EN


SYMBOL TABLE

TIME   C400   CHROUT FDED   CLOCK  0281
PROGRM 0384   YEAR   038D   TIME1  03A2
TABLE  03AC

:MGO PROGRM

1979 09/16 13:39:10.871
```

Figure 2. Assembled listing of the assembly language program used to print the output from a Mountain Hardware clockboard. sample run

Apple, con't . . .

supplied free to present purchasers who send in their cards. In addition to the generous selection of manuals, there are a number of other items in the language system package. These are:

- An autostart ROM and 16K of RAM. These are mounted on a circuit board that plugs into slot #0. If you have an Applesoft ROM card, it is replaced by the language system card. Autostart is discussed in the installation manual.
- Two new ROM's for your disk controller card so it will recognize the Pascal DOS. (Pascal has its own DOS.)
- Five Diskettes. Four containing the language system and a blank. One Pascal disk is for single drive systems. Two others are for multiple drive systems. Another is used for either and contains several system, utility and example programs. A wealth of Pascal programs are contained on these diskettes.
- One other diskette contains the two Apple BASIC languages.

Apple Pascal is an extensive system. It should not be taken lightly by the novice programmer. In fact, the Apple Pascal Reference Manual states that it is for the "experienced Pascal programmer." However, not easily intimidated by such warnings, my first two Pascal programs were working within a couple of days.

Actually, the first task was to learn enough to make copies of the master diskettes. And it was a good thing to do. A couple of programs were wiped out during my learning process. After the copies were made, the rest of the system was the next major task. And what a task it is! After much trial and error, my two programs would draw a triangle and print a few lines of text. I did, however, get familiar with the text editor and many of the other Pascal system features. (Pascal includes an extensive machine language assembler too.) It will take many months to become familiar with most of this extensive and powerful programming system. We should see many new and interesting programs as Apple Pascal becomes more popular.

Figure 1 is my first attempt at a Pascal graphics program. There is plenty of information in the Apple Pascal manual on Apple Pascal commands and syntax but there are very few examples of easy-to-understand applications. So I listed one of the graphics demonstration programs and used it to figure out what to do. The program in Figure 1 is a modification of a program in the textbook by Bowles. Most of the textbook programs will need to be modified to add Apple Pascal commands.

```
:$384L

0384-   A9 C4     LDA   #$C4
0386-   85 39     STA   $39
0388-   20 00 C4  JSR   $C400
038B-   A2 04     LDX   #$04
038D-   BD AC 03  LDA   $03AC,X
0390-   09 80     ORA   #$80
0392-   20 ED FD  JSR   $FDED
0395-   CA        DEX
0396-   10 F5     BPL   $038D
0398-   A9 BA     LDA   #$BA
039A-   8D 88 02  STA   $0288
039D-   8D 8B 02  STA   $028B
03A0-   A2 13     LDX   #$13
03A2-   BD 81 02  LDA   $0281,X
03A5-   20 ED FD  JSR   $FDED
03A8-   CA        DEX
03A9-   10 F7     BPL   $03A2
03AB-   60        RTS
03AC-   39 37 39  AND   $3937,Y
03AF-   31 8D     AND   ($8D),Y
:
```

Figure 3. Disassembly of the clock program from the apple monitor. Only absolute addresses can be used with Apple's assembler.

In this example, the USES TURTLEGRAPHICS command and the TEXTMODE command were the required modifications. TURTLEGRAPHICS tells Pascal it will be drawing pictures. TEXTMODE returns the screen back to the text mode. The PENCOLOR (WHITE), DRAW and TURN lines make the triangle. READLN is an input statement. This command stops the program until a key is pressed (for instance).

You can see the program doesn't look anything like BASIC. In fact, there is very little comparison between BASIC and Pascal. So if you intend to give Pascal a try, and I recommend it, expect to learn a whole new way of doing things.

Even though Pascal has a lot of appeal, and is likely to become very popular, it will not replace BASIC. And there is no reason why it should. BASIC doesn't have all the bells, whistles and structured design of many other languages but it does have universal acceptance and programming information is available to anyone. BASIC will remain a major language in the computing world for a long time. And, in that regard, this column will support both Apple BASIC's as well as Pascal. There are a number of applications where Integer BASIC is better than Applesoft. It runs faster and many things are easier to do. Furthermore, Pascal runs faster than either BASIC. Future columns will include programs doing things in each of the languages and examples of how to do the same thing in each language.

How about the native language of the Apple's 6502 microprocessor? Assembly language programming (and entry of machine language) is possible directly from the keyboard of the Apple II. Short assembly language programs are easily entered from the keyboard. Assembly into machine language is automatic with the Apple mini-assembler. Or you can enter the machine language into memory using monitor commands. For more extensive assembly language programming, there are several 6502 assemblers available (including the one in the Apple Language System).

Machine language programs provide a convenient way to run short routines from your main programs. As an example, Figure 2 is a routine to read the clock output from the Mountain Hardware clock board. The program (using the syntax of the S-C Assembler II assembler) indexes two tables to print out the year, date and time. First, the clock is called by initializing KSWH and the jump (JSR) to TIME. This causes the clock circuits to store the clock output in the keyboard buffer area. Then, an indexing command reads the year and the contents of TABLE are printed. Because of programming conflicts, the output of the clock uses semi-colons between the hours and minutes. The next few lines of the clock routine puts colons in these memory locations. Now, the program indexes the clock

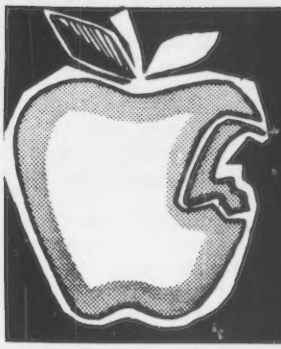
```
0398- A9 BA     1200          LDA #$BA     COLON
039A- 8D 8B 02  1210          STA $028B    SWAP IT
039D- A2 0B     1220          LDX #$0B     INDEX COUNT
039F- BD 89 02  1230 TIME1    LDA CLOCK,X  DATE & TIME
03A2- 20 ED FD  1240          JSR CHROUT   PRINT IT
03A5- CA        1250          DEX          TABLE DONE ?
03A6- 10 F7     1260          BPL TIME1    NO-GO BACK
03A8- A9 8D     1262          LDA #$8D
03AA- 20 ED FD  1264          JSR CHROUT   PRINT IT
03AD- 60        1270          RTS          END IT


:MGO PROGRM

1979 09/16 13:36

:
```

Figure 4. Example of a program modification to print out a shorter version of the Year, Date and Time program.
sample run



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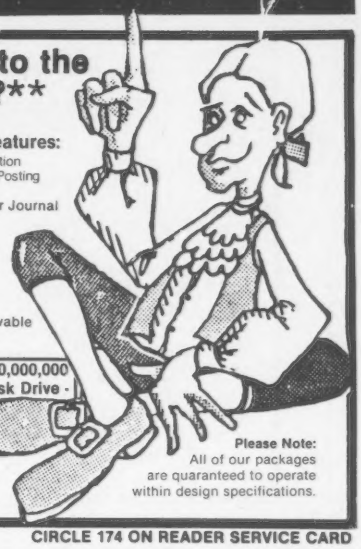

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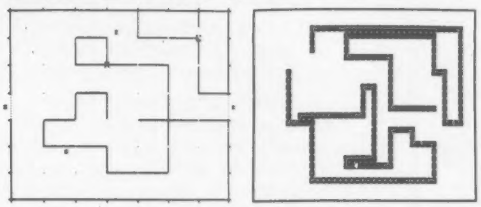

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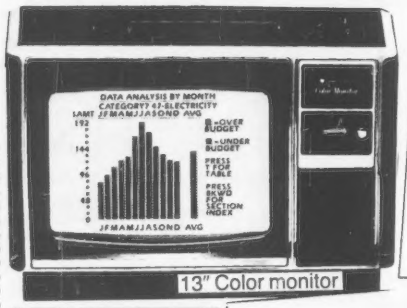

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output and prints the values. Note that both of the indexing routines start at the end and go in reverse. This was necessary because that's the way the clock output is stored. Also, it takes fewer instructions to index a table this way. Use 384G or CALL 900 to run this program.

Compare the listing from the S-C Assembler in Figure 2 to the listing of the same program from the Apple monitor (Figure 3). The output lacks the extended features of the S-C Assembler but does a more than creditable job. Also, the Apple assembler is available just as soon as you turn on the power to your Apple. For a shorter print out of the clock data, the program modification in Figure 4 can be used. Most of the time you only need the current date and time to the nearest minute. These programs make it possible to have some control of your programs when you are making lots of listings. The clock output from the Mountain Hardware board can be used from BASIC programs, too.

For those who like to tinker, some hardware ideas will be described in future columns. With the avaiability of 4 latchable bits, 3 input sensing bits and 4 analog to digital bits, there are several easy I/O possibilities. You can measure temperature, control lights or LED's, measure wind speed and sense remote switch activity. With only a few easy-to-obtain parts and some wire, you can connect a variety of control circuits to the game paddle socket. Simple and interesting hardware ideas will be included in this column. All will be easy to build, inexpensive and controlled from Apple II programs.

Interfacing your Apple to peripherals is always a timely subject. My printer, the one used to make the listings in the figures, is a new Decwriter IV, Model LA-34, and it is a real bargain. A full typewriter style keyboard gives you all the ASCII characters in upper and lower case. The printer has 4 character pitches and 6 line spacings. All the features are selectable from the keyboard or your program. The LA-34 is a table top model and weighs only 22 pounds. The print quality is the usual fine quality produced by DEC's 7 X 9 dot matrix. The LA-34 is available from Heath Co. for $1295.00 or from any DEC dealer.

Next time . . . new product information, software information and sources of information for using and enjoying your Apple II. More programming hints, suggestions, aides and techniques will be included, too. There are a lot of things going on with and for the Apple. This column will provide a source of timely information for your programming enjoyment. □

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by Gregory Yob

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Play It Again, PET!

Several manufacturers now provide Digital To Analog converter boards for the PET's User Port, and one result is a vast increase in the quality of the music the PET can play. (Listening to CB2's raucous sounds can be a bit annoying after a while.) I obtained the D/A board from Micro Technology Unlimited (PO Box 4596, Manchester, NH 03108) and their PET Music Software, and here is a report for your consideration. (MTU's board & software costs about $70.00, and an additional $15.00 gets you the source listing of their software which is in machine language.)

The K-1002-2 D/A board is about 5 inches square with two edge connectors. It plugs into the PET's User Port and Second Cassette Port. (Or First Cassette Port if you have a "new" PET.) On the side opposite the connectors a duplicate set of User Port and Cassette Port pins are placed, and a RCA phono plug is between the duplicate pins.

The board draws power from the +5V on the Cassette Port, and can drive a small (3 or 4 inch) speaker or be attached to your audio system. A volume pot is on the board so you can play your PET without disturbing others.

When the volume is set to the lowest setting, the board draws about 50 mA - if other devices are attached via the duplicate pins, the D/A board will not interfere with their operation.

The duplicate pins are very handy - I no longer have to continually replace the MTU board to use other User Port accessories. Hats off! to MTU for being so thoughtful! (A tiny annoyance is that the polarization slots aren't there - a bit of work with a hacksaw fixed that one.) The CB2 line is also connected to the amplifier, which lets programs with sound effects function normally.

I connected the board to my PET and tried the small test program - which worked just fine - and then loaded the music tape and typed RUN. Voila! 76 Trombones in four part harmony came out of my speaker, and what an improvement over the CB2 screeches and rasps that my PET was used to doing!

After several plays of 76 Trombones, and showing it off to my friends, it became time to look at the software in more detail. (A DIGRESSION: Several years ago, when Altair was an important word, and one's first computer had a total of 256 bytes, Steve Dompier wrote a music program that "played" by tuning an AM radio and putting it next to the computer's radio frequency noise. We spent most of one afternoon entering the program and the notes for Daisy, Daisy. A few hours listening to Daisy, Daisy left me unwilling to hear any more of it.)

Alas, Alack! The software is all in **Machine Language!** Those of you who know how the PET Monitor works, and the rudiments of 6502 coding will not have much trouble. If your skill is only in BASIC, using the MTU software is like programming in Linear A! (Linear A is a yet-undeciphered version of ancient Greek.)

The Machine Language Problem

I don't want to yell at MTU for slighting BASIC for several reasons. First, it is impossible to play good music using only BASIC. BASIC simply isn't fast enough. (By a factor of about 100). Second, the software was originally developed by Hal Chamberlin (who is part of MTU) for the KIM. The original version has been published and described in detail by BYTE (MTU provides a reprint of the BYTE article with their software.) Developing hardware is usually less than half the effort required in producing a new product. The first version of this board was for the KIM, and KIM users are expected to know machine language. Third, MTU has several BASIC interfacing programs under development.

In a general sense, any machine that speaks BASIC can do more, at a faster pace, if it is programmed in its machine language. In some cases, such as this one, the machine language permits feats that are impossible from BASIC. As more and better products emerge for the PET, more of these will have their software in machine language.

I don't expect my Creative Computing readers to know anything about 6502 machine language, and I feel it is out of place to attempt 6502 tutorials in this column. As a compromise, I will describe some short BASIC programs that can be made to "talk" with the MTU software to provide some fun and exploration.

If you are designing a machine language oriented product, may I make a suggestion: Start your software at 4096_{10} ($1000) and POKE BASIC's pointers to leave the user with an effective 4K PET. Study the following, and note that the tape LOADs can be eliminated.

Humanizing the MTU Software

My preferred PET tongue is BASIC, and a look at the MTU's memory map revealed several areas: (All addresses in decimal.)

Area 1: 1024 - 1898	Copy of PET Monitor
Area 2: 1899 - 2815	MTU's Software (Code)
Area 3: 2816 - 3839	4 Waveform Tables (Data)
Area 4: 3840 - 4095	Sequencing Data
Area 5: 4096 - 8191	Musical Data

PET, con't . . .

If I POKEd my PET to think that its memory ended at 2815, I could put short BASIC programs in Areas 1 and 2 to look at and change the data Areas 3, 4 and 5. Later, I could LOAD Areas 1 and 2 with the MTU software, and see (hear, really) the results of my fiddling.

If the program in Areas 1 and 2 read a PET data tape, a larger BASIC program could prepare the tape. For example, MTU's software requires a note to be a number that is not obviously related to the note's name and octave. The large BASIC program could "compile" these numbers, and the small program could load these into the PET where the MTU software expects them. (I won't get into this here for limits of space and general interest to my readers.)

The first step is to make a tape that has the MTU software for Areas 1 and 2. The procedure is:

1) LOAD the MTU software tape.
2) SYS(1039) to get into the Monitor.
3) S,01,MTUSTUFF,0400,0B00 (writes the tape)
4) X to exit the Monitor.
5) rewind & VERIFY the tape.

Next, make a tape that has the data in Areas 3, 4, and 5. With the MTU software already in place, LOAD the song tape. (In my case, the MTU tape has two programs. First is the MTU code, and second is a musical selection, "76 Trombones").

Now, do Steps 2 to 5 as mentioned above, with Step 3 changed to:

3) S,01,DATAREA,0800,1900

If your selection wasn't 76 Trombones, use the range 0800,2000 to be safe. (Or use the M command to find where the song data ends. When the PET is turned on, BASIC fills memory with the value 24(hex) until it finds the top of memory.)

The DATAREA tape is my "insurance" that a playable song is in the PET's memory. If I make a mistake, loading the DATAREA tape will get my 76 Trombones back.

Now it is time to POKE BASIC into the "micro-PET" - that is, make BASIC think the top of memory is at 2815. This step need be done only once, but should be done before any BASIC code is entered.

```
NEW

READY.
POKE 134,255:POKE 135,10

PRINT FRE(Ø)
 1787
```

To check that all is well, try SYS(1899), and the song should still play properly. (NEW only changes the PET's pointers, and does not alter any code that is present. However, watch out if you enter any BASIC lines!)

If you have a "new" PET, use

```
POKE 52,255:POKE 53,10.
```

My first experiment is to change the waves stored in Area 3 from the organ-like tones used in "76 Trombones" to some other sounds. The MTU software stores each "voice," or separate instrument's sound as a block of 256 bytes. Each block is a table of values that represents the sound wave generated by the voice. Since the values are added together by four voices, the blocks hold values in the range of 0 to 64.

My initial thought was to provide a simple "menu" of waves that could be put into each voice. This resulted in:

```
10 PRINT"clr SOUND MENU dn"
20 PRINT"1 - SQUARE"
30 PRINT"2 - RAMP"
40 PRINT"3 - TRIANGLE"
50 PRINT"4 - NOISE"
60 L1=2816
70 FOR V=1TO4:PRINT"VOICE:"V;
80 INPUT W:IF W>5 THEN 80
90 ON W GOSUB 500,600,700,800
100 L1=L1+256:NEXT V
110 PRINT"LOAD MTUSTUFF & SEE":END

500 REM SQUARE WAVE
510 FOR J=0 TO 255
520 POKE L1+J,63
530 IF J>127 THEN POKE L1+J,0
540 NEXT:RETURN
600 REM RAMP WAVE
610 FOR J=0 TO 255
620 POKE L1+J,INT(J/4)
630 NEXT:RETURN
700 REM TRIANGLE
710 FOR J=0TO127
720 POKE L1+J,INT(J/2)
730 NEXT:FORJ=0TO127
740 POKE L1+J+127,64-INT(J/2)
750 NEXT:RETURN
800 REM NOISE
810 FORJ=0TO255
820 POKE L1+J,64*RND(1)
830 NEXT:RETURN
```

Be sure to SAVE this program before loading MTUSTUFF! This program displays the waveforms menu and asks for the number desired for each voice. When it is finished, Load MTUSTUFF and RUN. Your song will now be played with the new voices installed.

I did have a bit of trouble loading the SOUND MENU - occasionally the first few lines would be missing. If you have this problem, start with a reset PET.

Some waves are "smoother" than others. The smoothest waves will not have any sudden jumps - be sure to check that the 0th and 255th values are nearly equal. The slope of the wave also shouldn't change abruptly - if you draw a graph of your wave, there shouldn't be any "corners." Since SOUND MENU has lots of room left, I added a few more waves:

(Make the following additions & changes:)

```
52 PRINT"5 - HARMONICS"
54 PRINT"6 - LINE SEGMENTS"
55 PRINT"7 - BROWN NOISE"
60 L1=2816:DIMA(30)
80 INPUT W: IF W>7 THEN 80
90 ON W GOSUB 500,600,700,800,900,1000,1100

900 REM HARMONICS
910 A=Ø:INPUT"# HARMONICS";N
920 FORH=1TON:PRINT"FACTOR FOR"H;:INPUTA(H)
    :A=A+A(H):NEXT
930 C=π/128:F=32/A:FORJ=0TO255:Z=32:FORH=1TON
940 Z=Z+A(H)*F*SIN(C*J):NEXT:POKE L1+J,Z:NEXT
950 RETURN

1000 REM LINE SEGS
1010 X=Ø:Z=Ø:PRINT"-1,-1 TO QUIT"
1020 PRINT"AT:"X;Z:INPUT"INCR,HT";I,H
1030 IF I>Ø THEN I=255-X:H=PEEK(L1)
1035 IF I=Ø THEN 1080
1040 IF H>63 THEN 1020
1050 IF X+I>255 THEN I=-1:GOTO 1030
1060 S=(H-Z)/I:FOR J=Ø TO I:POKE L1+X+J,Z+S*J
     :NEXT
1070 X=X+I:IF X>254 THEN RETURN
1080 Z=H:GOTO 1020

1100 REM BROWN MOTION
1110 X=32:FORJ=ØTO127
1120 Z=INT(11*RND(1))-5
1130 X=X+Z
1140 IF X>64 THEN X=64
1150 IF X<0 THEN X=0
1160 POKE L1+J,X:POKEL1+256-J,X
1170 NEXT:RETURN
```

The HARMONICS option lets you specify the number and relative strengths of up to 30 harmonics. The code in Subroutine 900 adjusts the amplitudes to a maximum of 63 and a minimum of 0 - all you have to do is enter their strengths in a comfortable way. (For example, 1,2,3 results in the same values as 1000,2000,3000.)

MTU's software also provides a harmonic synthesis routine, so this BASIC version is redundant, though simpler to use.

The LINE SEGMENTS option lets you "draw" a wave made up of line segments. It will tell you your location in the table and ask for the distance to the next point and its value. (If you give an increment of zero, the current value can be changed - a useful trick to set the first point.) LINE SEGMENTS then fills the intermediate points with a line. It will also draw the last line when you quit to connect smoothly with the first point in the wave table.

BROWN NOISE changes the amplitude by a value from -5 to +5 for each table value. To ensure that the ends will meet in the table, it puts the same value at the start and finish of the table, and works towards the middle.

MTU's software uses Area 4 to specify a song in a high-level way, with control of tempo, number of voices, assignments of waves to voices and the location of song segments. Area 5 stores the sequences of notes that can be combined to make the song.

The actual compilation of a song is like hand-assembling machine lan-

PET, con't . . .

guage code - the user has to keep track of a lot of things at once! A BASIC song-compiler would be useful, especially for musicians whose interest lies in the song, and not all the gymnastics required to make music on the PET.

Briefly, a music compiler would have two parts. First, a short and simple program that fits in the same space that SOUND MENU does would read a data tape. On the tape would be strings in MONITOR type format, like "033A F1 B2 C3 D4 E5 4A 35 00." The first value is the location to start loading the following bytes into memory. (See the March issue of Kilobaud, p. 68, Example 8, for a BASIC program that does the same thing with the strings in DATA statements.) The program takes the strings and puts the indicated bytes in the correct memory locations.

The other program has the intelligence to take entries in a music-like format and prepare a data tape for the small program. For example, MTU's code for a G-Sharp in the first octave is 8C. This "compiler" handles the conversion, prepares tempo and voicing options and other "housekeeping" tasks. Of course, all 8K in a PET would be needed for this.

To sum up, the MTU D/A board & software can do quite a bit, and will require a lot of hard work to make it truly "User-Oriented." I hope I have provided some clues to simplify this challenge.

About Scrunching Data

I am sure some of you have entered a long program, only to be defeated by ?OUT OF MEMORY ERROR. One approach is to "crunch" your program - with illegible results. The "crunch" tricks that work the best are:

1) Remove all REMs.
2) Wherever possible, make multi-statement lines - each line number takes 5 bytes.
3) Re-use variables as much as possible.
4) Remove all blanks in BASIC code lines - blanks eat space.
5) Replace two letter names with one-letter names.

A better approach is to reduce the space used by your variables and data - if you do this first, your program might be readable after all.

Check to see if some of your data can be represented in arrays. Each new floating point array value takes 5 bytes - if simple variables are used, the space used is 7 bytes. If you use arrays, check to see how often the array elements appear in the program. Each array reference takes 3 to 4 bytes for the (value) in the program. For example, the statement A=2 takes 7 bytes for the variable A, and 3 bytes for the statement for a total of 10 bytes. The statement A(3)=2 takes 5 bytes for the element in array A() and 6 bytes for the statement, for a total of 11 bytes. If the values you are storing in an array aren't really related to each other, it is better to use simple variables.

If your values are integers in the range -32767 to +32767, consider using integer variables, ie A%, etc. For simple variables, there is no saving with integer values. First, each integer variable still takes 7 bytes. Second, each use of the variable in the program takes an extra byte for the % symbol. If you use integer arrays, considerable savings result - each new integer array element takes only 2 bytes.

If your values lie in the range of 0 to 255, consider using a string to store them. A string can be considered as an array of characters and MID$, CHR$ and ASC used to transfer between the string values and the numbers you really need. An added advantage of string storage is that the PET's dynamic allocation of strings eliminates the need to DIM the storage area first - you only use the space that is needed instead of the maximum amount that is expected.

If these methods aren't sufficient, there are still ways and means. Here are some illustrations of data-scrunching:

1) Suppose you have an inventory of items, with prices in the range of $0.01 to $ 99.99 - how can integer variables come to your rescue?

If each value is multiplied by 100, the numerical range is from 1 to 10000 - easily within the range of integers. As a program it might look like this:

```
10 DIM P%(200)
20 INPUT"ENTRY OR RETRIEVAL (E OR R)";A$
30 IF A$="E" THEN GOSUB 100
40 IF A$="R" THEN GOSUB 200
50 GOTO 20

100 PRINT"ENTRY - USE -1,1 TO EXIT"
110 INPUT"ITEM#,PRICE";I,P
120 IF I<0 THEN RETURN
130 IF I>200 OR P>100 THEN PRINT"ERROR":
    GOTO 110
140 P%(I)=100*P
150 GOTO 110
200 PRINT"RETRIEVAL - USE -1 TO EXIT"
210 INPUT"ITEM#";I
220 IF I<0 THEN RETURN
230 IF I>200 THEN PRINT"ERROR":GOTO 210
240 PRINT"ITEM #"I"IS $"P%(I)/100
250 GOTO 210
```

Lines 140 and 240 are the heart of the data compression scheme. Each price is multiplied by 100 to go into the price table P%(), and divided by 100 to be displayed on retrieval.

Most of this program is for the convenience of the user. Those of you who want to do "business applications" should take note here. Lines 20 to 50 allow entry of the E or R options - any other entry just repeats the request. Lines 130 and 230 check to see if I, the item #, is in the range 0 to 200 (the program will blow up if it isn't), and that the price isn't over $100.00. If a check fails, the ERROR is printed, and a chance to try again is offered. A better program would explain what the error was, ie, ITEM NUMBER TOO LARGE, or PRICE TOO LARGE.

2) Suppose you have several smallish numbers, for example,

SIZE is from 2 to 17, HEIGHT is from 48 to 85, WEIGHT is from 22 to 315, and AGE is from 5 to 95. If four integer array elements are used, the space requirement is 8 bytes per entry. If these values can be crammed into one floating point number, only 5 bytes will be needed per entry.

If the largest values for each item are multiplied together, we get 43241625 - so a PET floating point number can store all of these values in one number. Here is a short example - I am omitting the usual details that make everything nice:

```
10 INPUT"SIZE,HEIGHT,WEIGHT,AGE";S,H,W,A
20 S=INT(S):H=INT(H):W=INT(W):A=INT(A)
30 V=S+18*H+18*86*W+18*86*316*A
40 PRINT"YOUR CODE VALUE IS:"V

100 INPUT"CODE VALUE";V
110 D1=INT(V/18)
120 PRINT"SIZE",V-D1*18
130 D2=INT(D1/86)
140 PRINT"HEIGHT",D1-D2*86
150 D3=INT(D2/316)
160 PRINT"WEIGHT",D2-D3*316
170 PRINT"AGE",D3
180 GOTO 10
```

Lines 10 to 40 encode the four small numbers into one larger one. Line 20 is required, for this scheme depends on each number being a finite set of

A Late Flash: Micro Technology Unlimited mentioned to me that several software packages were under development for their music board. The new software will emphasize the "human interface" so musicians without prior experience with computers (and students too) will be able to use the programs. Other features include graphical displays of notes, waveforms, etc. Also, attacks and decays will be available. (!!!).

PET, con't . . .

values, ie, SIZE is 2,3,4 . . , 17 and not 2.5, 2.45, etc. If your numbers can't be made into integers, this method won't work.

Lines 100 to 180 decode the number by dividing again and again and reporting the remainder. Note that the numbers used for multiplication and division are one larger than the expected largest number of each kind.

This trick is similar to how we use ordinary numbers. For example, 123 is 100*1 + 2*10 + 3 - the base, of course, is 10. The time of day can be seen as a number with different bases, for example, 12:45:36 is really 12*3600 + 45*60 + 36. In our example, we chose the bases as the largest number in each range plus one, or as line 30 shows, 18*86*316, 18*86 and 18.

If too many numbers are put together, the PET won't recover them correctly. A way to check this is to multiply the maximum + 1 values for each number together, and see if the PET prints an integer, or uses scientific notation (like 1.23456789 E23).

In our example, some of the numbers, like HEIGHT, don't use their full range. Subtract the lowest value for each number from the largest, and then do the multiplication.

First try: 18*86*316*96 is 46960128

Second try: (18-2)*(86-48)*(316-22)*(95-5) is 16266432

In crowded cases, this will bring the number into a usable value. When the number is coded, first subtract the smallest value, and when the number is decoded, add the smallest value for each number.

Well, space runs out, so, on to next month! □

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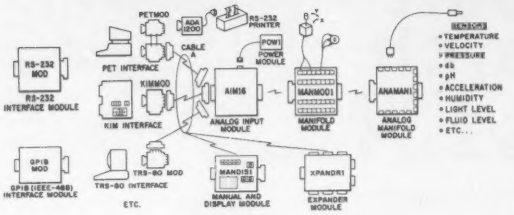
Data Acquisition Modules

DAM SYSTEMS

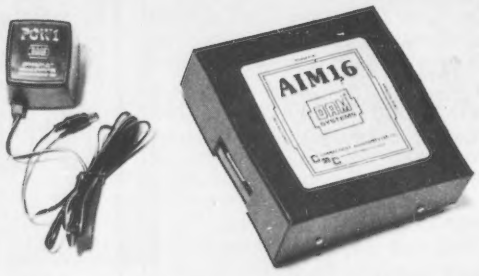


The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

Computers do not understand voltages: They understand bits. Bits are digital signals. A device which converts voltages to bits is an analog-to-digital converter. Our AIM16 (Analog Input Module) is a 16 input analog-to-digital converter.

The goal of Connecticut microComputer in designing the DAM SYSTEMS is to produce easy to use, low cost data acquisition modules for small computers. As the line grows we will add control modules to the system. These acquisition and control modules will include digital input sensing (e.g. switches), analog input sensing (e.g. temperature, humidity), digital output control (e.g. lamps, motors, alarms), and analog output control (e.g. X-Y plotters, or oscilloscopes).

Analog Input Module



The AIM16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the DAM SYSTEMS special interfaces.

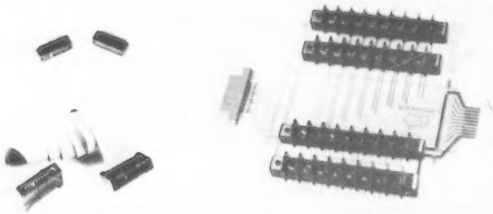
The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.

AIM16... $179.00
POW1a... $ 14.95
POW1e... $ 24.95

Connectors



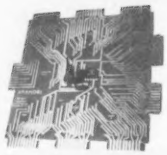
The AIM16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the DAM SYSTEMS computer interfaces and the AIM16 or XPANDR1 and between the XPANDR1 and up to eight AIM16s.

ICON... $ 9.95
OCON... $ 9.95
MANMOD1... $59.95
CABLE A24... $19.95

XPANDR1



The XPANDR1 allows up to eight AIM16 modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16. Up to eight AIM16 modules are then connected to each of the eight ports provided using a CABLE A24 for each module. Power for the XPANDR1 is derived from the AIM16 connected to the first port.

XPANDR1 . . . $59.95

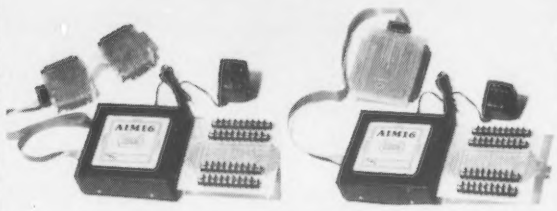
TEMPSENS

This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules).

Resolution for each probe is 1°F.

TEMPSENS2P1 (-10°F to 120°F) . . . $49.95

Computer Interfaces and Sets



For your convenience the AIM16 comes as part of a number of sets. The minimum configuration for a usable system is the AIM16 Starter Set 1. This set includes one AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. Both of these sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for several home computers.

The PETMOD plugs into the back of the Commodore PET computer and provides two PET IEEE ports, one user port and one DAM SYSTEMS port. The PETMOD is connected to the AIM16 or XPANDR1 with CABLE A24. The PETSET1 includes one PETMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD1. To read and display a single AIM16 channel (N) using the PETSET1 the BASIC statements

```
POKE59426,N:POKE59426,255:X=PEEK(59471):PRINT"CHANNEL "N"="X
```

are all that is needed.

The KIMMOD plugs into the COMMODORE KIM applications connector and provides one application connector and one DAM SYSTEM'S port. The KIMMOD is connected to the AIM16 or XPANDR1 with CABLE A24. Assembly and machine language programs for reading and displaying data are included. The KIMSET1 includes one KIMMOD, one CABLE A24, one AIM16, one POW1 and one MANMOD 1.

All sets come in American and European versions.

AIM16 Starter Set 1a (110 VAC) . . . $189.00
AIM16 Starter Set 1e (230 VAC) . . . $199.00
AIM16 Starter Set 2a (110 VAC) . . . $259.00
AIM16 Starter Set 2e (230 VAC) . . . $269.00
PETMOD . . . $ 49.95
KIMMOD . . . $ 39.95
PETSET 1a . . . $295.00
PETSET1e . . . $305.00
KIMSET1a . . . $285.00
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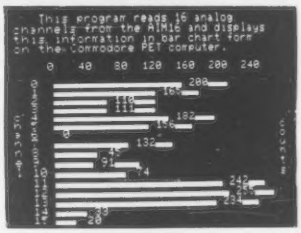
If you cannot see our products in advance, and order direct from us, we offer a money back guarantee. If our products don't perform as you expect, return the merchandise to us within 30 days, in its original condition, and we will refund the purchase price.

Our standard warranty for all our products is 90 days.


This program reads 16 analog
channels from the AIM16 and displays
this information in bar chart form
on the Commodore PET computer.
0 40 80 120 160 200 240

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Enforcement of software rights

Harold L. Novick

"Thief!" "Piracy!" "I'm being ripped off!" These are the charges of the owners and creators of software.

"It's in the public domain." "This is fair use." "My making one copy can't hurt anyone." "Deminimis non curat lex," which is translated as "the law does not notice trifling matters." (Every legal article needs some Latin.) "I rewrote it so there is no substantial copying." These are the answers of the software users.

This is not a game of Gunner, Battleship, Salvo, or Spacewar. These are not the slogans embodied in the programs listed in the book 101 BASIC COMPUTER GAMES, or its revision BASIC COMPUTER GAMES. Rather, these charges and answers are heard in the marketplace where personal computing software is being acquired, legally and illegally; the marketplace where software is bought, appropriated, stolen, traded, and copied.

Whether one's use of another's software is legal or illegal depends upon how that software is protected. If the software is patented--which in this writer's opinion is possible for certain types of software--then any making, using or selling of the patented software would be an infringement. If the software is copyrighted, then anyone who reproduces, distributes copies or prepares derivative works of the software or, if applicable, anyone who performs or publicly displays the software would be infringing the copyright. If the software is sold or leased pursuant to a contract, then anyone who is a party to that contract would have to obey the contract terms or be liable for damages. In addition, under some circumstances, the defaulting party could be ordered by a court to carry out the terms of the contract. Obviously, anyone not a party to the contract would not have to honor the contract terms. Finally, if the software is protected as a trade secret, then anyone improperly obtaining the software could be liable to civil penalties and possibly even criminal penalties (if that person has stolen the software).

Most software being distributed in today's marketplace is protected at least by copyrights. More expensive software is also protected by trade secrets through a license agreement (i.e. a contract). Very little software is being patented.

Although most, if not all, software is being copyrighted, most law suits today for alleged misappropriation of software are not brought for copyright infringement, even when the software carries a copyright notice. A case in point involves the widely used, widely known Electric Pencil word processing system, developed by Michael Shrayer Software, Inc.

According to a news release and conversations with Mr. Shrayer and his attorneys, the Shrayer company filed suit in a California state court against Vector Graphics Inc. for misappropriation of the Electric Pencil software. If copyright infringement had been alleged, the lawsuit would have to be brought in Federal Court. Shrayer charged Vector Graphics with a breach of contract, fraud and deceit and asked for over a million dollars in damages.

According to its attorneys, Vector Graphics, Inc. responded to the lawsuit with a denial of the allegations and of any liability. Vector Graphics also responded with a combined thirty million dollar cross-complaint alleging that the press release had defamed Vector Graphics and that Shrayer had interfered with Vector Graphics' business relationships. It is easy to see that law suits involving software are expensive and can involve substantial economic exposures.

The Shrayer-Vector Graphics controversy is also interesting because of the business dealings used to promote the Shrayer software.

According to Shrayer, Electric Pencil I was originally licensed to Vector Graphics for incorporation into its Memorite I system. Vector Graphics had to pay a royalty for each system sold. Then, after operating this way for a period of time, Vector Graphics obtained five copies of Electric Pencil II on diskettes under a trade secret license agreement by which the diskettes could be sublicensed but the software could not be sold or modified, the copyright notice had to be displayed, and credit had to be given to the Shrayer company. The law suit charges that Vector Graphics not only violated the terms of this agreement, but also began selling a slightly modified version of the Electric Pencil II as their own Memorite II system without any accounting being given to the Shrayer company. The judge apparently thought that Shrayer would have a likelihood of success at trial because he agreed to issue a preliminary injunction, if certain conditions were met, preventing any further distribution of a Vector Graphics word processor that used any part of the Shrayer program. Naturally, Vector Graphics disagrees

Forum, con't . . .

and has stated that any similarities in the two programs is because of the similar features present in all word processors.

Whether the attempt by the Shrayer Company to protect its software is meritorious or not is up to the courts to decide. The fact that Shrayer has made its attempt based on a contractual theory, as opposed to a copyright theory, is indicative of the belief by many that the protection afforded by copyrights is not that strong or definite. When asked why this suit was not brought in Federal Court on a copyright theory, the attorney for the Shrayer Company made the interesting comment that it was the general feeling among the attorneys in his area that the existence of copyright protection for software was too uncertain and that his client was not interested in settling the law or making new law. Thus, when push comes to shove, those most affected still go with their best case and, for today at least, that case is not copyrights.

Furthermore, the attempt by Shrayer to protect what it considers to be its software reflects a growing mood in the personal computing field to take steps to stop what some call piracy and others call rip offs. Bill Gates began this campaign eons ago (i.e. at least three years ago) when he started complaining about hobbyists copying his 8K BASIC software. The campaign is about to be picked up by a new trade association called the Association of Software Producers & Publishers. They had their organizational meeting at the Personal Computing show in Philadelphia in October. (Inquiries should be directed to Jules Gilder, P.O. Box 153, Rochelle Park, NJ 07662.) CREATIVE COMPUTING magazine has also conducted a campaign to stop what it thinks is improper use of its software.

Unfortunately, there is much confusion among software distributors and software users as to what can and cannot be protected. This is reflected in the following portions of a letter by Norman Whaland of New York City.

> I like the discussions of software copyright, especially Harold Novick's article. I have to disagree with one point in your (i.e. Creative Computing's) policy on software enhancements. A copyright doesn't cober "any idea, procedure, process, system, method of operation, concept, principle, or discovery." (section 102b.) On the other hand, "derivative works" are covered. (section 106.) The question is, where do they draw the line?
> "Procedure?" I hadn't noticed that before. What does that do to the principle that paraphrase is infringement? It seems to me that a paraphrase of a program has nothing in common with the original **except** a procedure. Perhaps Mr. Novick can clear up this point.

Mr Whaland's questions will be discussed in detail in next month's Forum. The answers lie in an esoteric differentiation between the writing (copyrightable) and the underlying concept or idea (patentable perhaps, protectable by trade secrets, but not copyrightable.) Where the expression of an idea leaves off and idea itself begins is not always easy to determine in practice. But stay tuned until next month when an attempt will be made. □

PET Word Processor

8K and 16/32K PET versions

This program permits composing and printing letters, flyers, advertisements, manuscripts, etc., using the COMMODORE PET and a printer.

Printing directives include line length, line spacing, left margin, centering and skip. Edit commands allow you to insert lines, delete lines, move lines and paragraphs, change strings, save files onto and load files from cassette (can be modified for disk), move up, move down, print and type.

Added features for the 16/32K version include string search for editing, keyboard entry during printing for letter salutations, justification, multiple printing and more.

A thirty page instruction manual is included.

The CmC Word Processor Program for the 8K PET is $29.50. The 16/32K version is $39.50.

Order direct or contact your local computer store.

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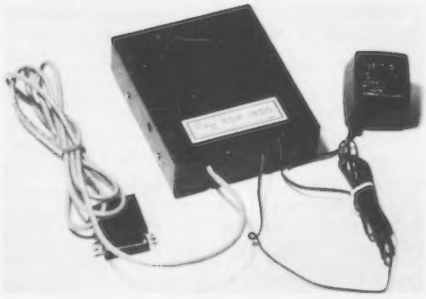

The CmC ADA 1200 drives an RS-232 printer from the PET IEEE-488 bus. Now, the PET owner can obtain hard copy listings and can type letters, manuscripts, mailing labels, tables of data, pictures, invoices, graphs, checks, needlepoint patterns, etc., using RS-232 standard printer or terminal.

A cassette tape is included with software for plots, formatting tables and screen dumps. The ADA1200 sells for $169.00 and includes case, power supply and cable.

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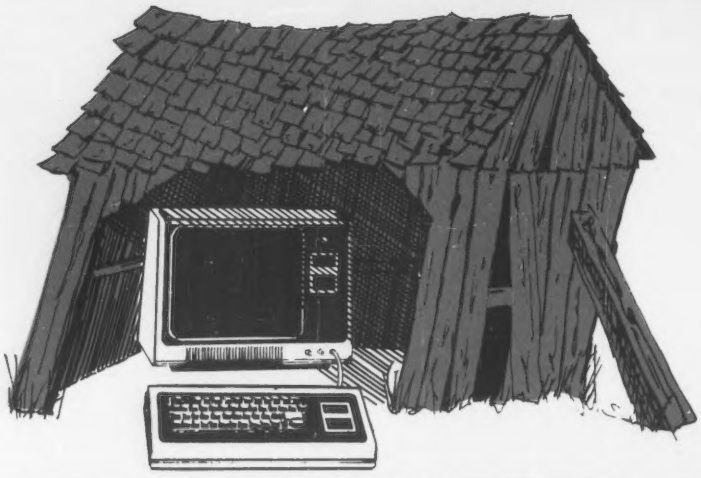
Stephen B. Gray



For the lucky thirteenth column, we have a look at a comment on an earlier graphics piece, the Soundware noise-and-music maker, a short program that creates some very weird patterns and another that allows keys to repeat, two software catalogs, a farewell to the Tandy 10 and a computerized hint to Neiman-Marcus.

My series on computer graphics will continue after a short break of an issue or two, probably with a look at the problems of trying to make straight lines and circles in raster-scan graphics, and at some advanced graphics - character graphics.

Missing Column, Missing Row

A letter from Hughes J. Glantzberg of Manassas, VA, commenting on the first graphics article in this column (Aug. 1979, p. 126), points out:

"Graphics is something most people know exists on the TRS-80, but few really know how to make effective use of what is available. The first program listed in the new series of articles, for example,

```
10 CLS
20 X=RND(127)
30 Y=RND(47)
40 SET(X,Y)
50 GOTO 20
```

purportedly will 'gradually fill the screen until the entire graphics display is painted white.' This is true except for the column where X=0 and the row where Y=0. The graphics display area of the screen runs from X=0 to 127 and from Y=0 to 47. The correct program should have been:

```
10 CLS
20 X=RND(128)-1
30 Y=RND(48)-1
40 SET(X,Y)
50 GOTO 20
```

"Appropriate changes should be made to the subsequent programs as well. When attempting to set or reset a pixel, caution should be taken so as not to exceed the bounds of the screen, in which case an FC error will occur."

He's right, of course. I'd gotten so used to using 127 and 47, because with 128 and 48, RESETs of X-1 and/or Y-1 cause FC errors, as he points out, that it was just more convenient to forget about that extra column and extra row.

So, when using the full graphics display area, as in that second program, be sure not to use, for example

```
45 RESET(X-1,Y-1)
```

because within seconds you'll get FC ERROR IN 45. And if you try to use

```
45 RESET(X+1,Y+1)
```

you'll get the same message, very soon. So if you would like to create a never-ending pattern by using both types of resets, you'll have to make do with a little less than the full graphics display area, as with:

```
10 CLS
20 X=RND(126)
30 Y=RND(46)
40 SET(X,Y)
43 RESET(X-1,Y-1)
46 RESET (X+1,Y+1)
50 GOTO 20
```

which uses all but the two outside rows and the two outside columns.

Soundware

Want to add sound effects and music to your Level-II TRS-80 programs? Then check out Soundware, from CAP Electronics (1884 Shulman Ave., San Jose, CA 95124). As the CAP ad says, "Games and programs come to life with laser sounds, bird calls, bounces, clicks, sirens, music notes, tunes and whatever else your imagination dreams up."

For $29.95 you get the Soundware speaker/amplifier unit and the Soundware Software cassette tape. If you prefer to run the sound into your stereo or some other speaker/amplifier combination, you can get the tape alone for $14.95.

Soundware speaker/amplifier and cassette, available for the TRS-80, PET and Compucolor computers. Shown here is the 8K PET version.

The "Introduction to Soundware" tape is a marvelous three-part combination of a demonstration of a variety of sounds, a program that lets you experiment with making sounds and, then, for using with your BASIC programs, the machine-language sound program itself.

First you put a couple of penlite batteries in Soundware. Unplug the AUX connector from the cassette recorder, and plug it into the Soundware jack, which is at the end of a two-foot cord. Then turn on Soundware, and turn up the volume a little.

Load the first program, Sound Demo, if you have 16K, which is required because 12 demo sounds, a menu and an opening display are included (the other two programs require only 4K).

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TRS-80, con't . . .

Some of the sounds are quite realistic, such as Saucer (flies up, up and away), Little Laser, Big Laser, Pong (the bounce sounds you need for many games) and Machine Talk (sounds like a robot talking). Bach Talk, although programmed at too fast a tempo, does know what kind of music can be made with TRS-80 output. Not very realistic, because of the lack of overtones that mean a great deal in some sounds, are Little Birds, Big Birds, Chipmunk and several others. But the dozen do give a fine idea of the range of sounds possible with the Soundware system. You can, incidentally, add overtones to the sounds by changing the duty cycle, with programming.

The second program, Sound Composer, gives you three examples of sounds you can listen to, and easily change as much or as little as you wish. You can branch out from there to create entirely new sounds.

First you're shown the five parameters and the range for each. Pitch has a range of 1 to 999, with middle C at 140, so you have a full range of about ten octaves, although the usable range is more like five octaves, from 560 for low C to 16, five octaves higher. (The higher the number, the lower the pitch). The instruction booklet gives a "table of pitch values for musical notes." These pitch values provide tones that are very close to the notes on a piano, so Soundware Software is actually in tune with the outside musical world.

The second parameter is duration. With just two parameters, pitch and duration, you can make music. But for sound effects, you need three more parameters: number of steps, step-size 1 and step-size 2. After the first note, specified by pitch and duration, you can play a second note, higher or lower than the first by a step size, and then a third note, specified by step-size 2. The number-of-steps parameter determines how many times the two step sizes will be repeated, over and over.

The first example in Sound Composer is a steady tone, specified by

100,500,0,0,0

which plays a note somewhere between F and F-sharp, for about a second. Change that to

100,500,4,10,5.

and you get the same initial tone, followed by four more notes, first a big step down, then a little step down, another big step down and one more little step further down. Steps 1 to 127 create lower tones. To get rising notes, use step sizes between 128 and 255. The rising-note equivalent of this previous sound is

100,500,4,245,250

which sounds like the first five notes of a harmonic scale.

The flying-saucer sound is created by

250,25,249,5,248

which translates to starting with a short D note, followed by 249 steps of moving down 5 and up 7 (255 minus 248 equals 7), which creates a rising, warbling tone - up, up and away . . .

Running the third program, called the "TRS-80 sound machine-language program," loads this "MLP" into your TRS-80. You use it as a subroutine and call it up with USR(0) within your BASIC programs.

The actual programming is only a little more complicated than what you do in the Sound Composer demo program. You pass numbers to the MLP with POKE statements, and use PEEK statements for control, in addition to using the five parameters. (In MLP, a couple more parameters are available, for programming some really fancy complex sounds.)

More could be said, but for $29.95 you can try it yourself. The speaker/amplifier is actually a transistor radio, without a tuner or dial. You could do without it, by using your stereo instead, but Soundware is a convenient, ready-to-run little box much easier to use than your hi-fi. It can easily sit on the top-right edge of your TRS-80 keyboard, and lean back against the video-display case.

There's an earphone jack on one side of Soundware, very handy when children are using the sound-maker.

By the time you read this, the three Soundware Software programs on the cassette tapes will have been changed slightly so as to be compatible with Level-II DOS, at no change in price. You'll be able to upload the three programs to disk, as well as use them without disk.

There are several hardware music generators for the TRS-80, costing from $75 to $90 or so. One manufacturer tells me he's back-ordered. But another has gotten so few orders from his ads that he may never produce more than his two prototypes; he claims the software music-makers, such as Soundware and Radio Shack's Micromusic tape (to be reviewed here soon) are just too much competition for his programmable tone generator.

One of the hardware-music-generator manufacturers said the advantage of his machine is that it produces highly accurate tones, and the software systems don't. However, the programmer of the Soundware Software told me that Soundware is more accurate in pitch than hardware generators because the tones are timed off the TRS-80 crystal, and the resolution is 16-bit. The bottom octave is within 0.01 percent of exact pitch, he says, and the top octave is only slightly off, a little over two percent (enough to be heard).

Short Programs 4 & 5

The "Radio Shack Microcomputer Newsletter" is sent to everybody who owns a TRS-80, and contains information on new TRS-80 hardware and software, items on sale, programming tips and other helpful material.

If you have a TRS-80 but aren't getting the newsletter, you can pick up a copy at most Radio Shack stores, and fill in the form (there was one in the June 1979 issue) to get on the mailing list. If you can't find a newsletter, you can write to Computer Merchandising, Radio Shack, 700 One Tandy Center, Fort Worth, Texas 76102. But you have to own a TRS-80 to get on the mailing list.

Speaking of graphics, that June 1979 issue has a Pattern Fun program that creates the weirdest TRS-80 patterns you've ever seen.

```
10 REM 1. RUN THE PROGRAM
20 REM 2. PRESS ANY COM-
   BINATION OF KEYS
30 REM 3. THIS WILL START A
   PATTERN
40 REM 4. PRESS ANY OTHER
   KEYS TO CHANGE THE
   PATTERN
50 POKE 16396, 23:CLS
60 FOR N = 14336 TO 15360
70 PRINT (CHR$ (PEEK (N)));"";
80 NEXT N: GOTO 30
```

A very few keys will create patterns just by pressing that one key, such as 6, F, V, N and the period, all of which print, at different speeds, eight rows of @@@@@ at the top of the screen, wipe them out, and start over again. The combinations of two or more keys are what create patterns you might have a tough time figuring out as to why they appear.

For instance, 68 causes an alternating @ and A, 16 of each, and QW causes alternating graphics blocks and blanks in a pattern that looks something like a fully perforated IBM card.

Another oddball is WTF (a skyful of blocks and @@) and so is WTK (fast-working moth). An "inchworm" pattern is created by 3- while 3. is similar but leaves a long trail; 3M leaves a shorter trail.

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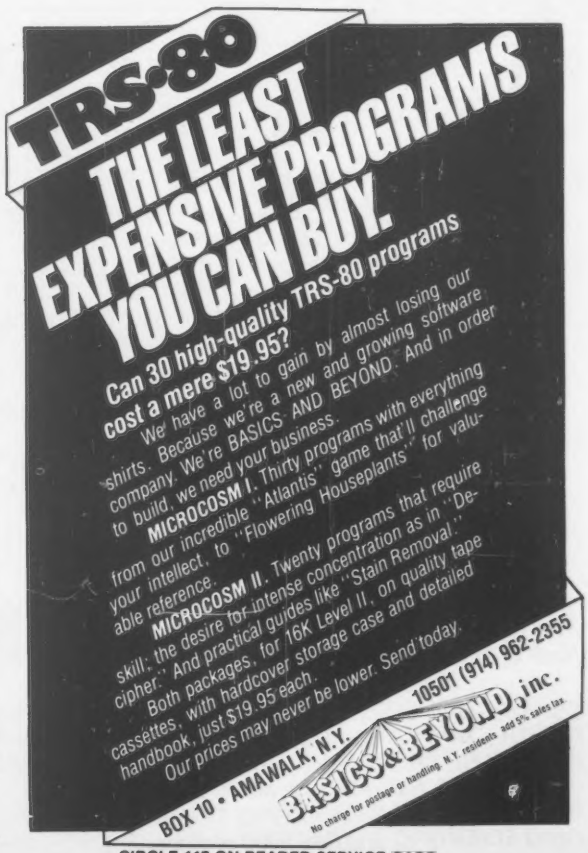
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TRS-80, con't . . .

The up-arrow creates a whole series of patterns with "hesitating" portions; these have to be seen to be believed, caused by QW↑, W↑, WT↑, QWT↑, to say nothing of N↑.

Large combinations of keys cause even more peculiar patterns, such as ERGJL (birthday cakes for children), POTY (birthday cakes on a tablecloth), WDJP (weaving pattern), WERHJK (mythical beast), WERJKL (square elephant).

Try SDGJL@ for a nice textile pattern. If you can lift your J finger at just the right times, you can create an even nicer pattern.

All the keys can be used, including BREAK, ENTER, CLEAR, SHIFT, SPACE and the four arrow keys; in this program, they no longer perform their usual functions. For instance, try GJL with BREAK, ENTER and CLEAR, to get a double-width latticework.

Secret messages are revealed by AFBKP with the CLEAR key down. ASFBL@→ also gives a message; raise your F finger just for a moment, and the message is changed to double-width characters.

In the "just plain crazy" category is XCVN,/ and XCGN,/ is even crazier. WET79: creates a pattern of suburban row-houses. XEVNO/ creates looney "champagne bubbles," although somewhat flat. Hold down SEGIL, press H now and then, and you've got quite a screenful.

Once you RUN this, you can't LIST it unless you first press the reset button at the left rear of the keyboard.

Since almost every combination of keys, from two keys on up, creates a different pattern, you could spend weeks and maybe months trying to find them all. Happy hunting!

Question: Does this program have a practical use as a graphics subroutine? Question two: Will Robert Elliott Purser make a list of all the combinations?

I couldn't find out who wrote this, but Tahl Milburn, a systems programmer for Tandy Systems Design in Fort Worth, explained how Pattern Fun works.

Line 50 disables the BREAK key, because some combination of keys might just equal the BREAK code and stop the program. The program will work without this line.

Line 60 gets characters before they go through the keyboard decoding routine, before they get translated into ASCII, by picking them up directly from keyboard memory. Although 1024 characters are scanned by the program, only the first 256 are used, so you could speed up the program by changing the line to read

60 FOR N = 14336 TO 14592

Line 70 picks up a character from the keyboard memory and displays it. The "" at the end of line 70 is not necessary, nor is the outer pair of parentheses.

In minimum form, the Pattern Fun program could be pared down to:

```
10 FOR N = 14336 TO 14592
20 PRINT CHR$(PEEK(N));
30 NEXT: GOTO 10
```

This will fill the screen with a pattern that remains as long as you wish, after you've pressed two or more keys; the original program fills eight lines on the screen, then clears it and starts over again; if you take your fingers off the keys, the pattern disappears in about four seconds. Also, the longer program disappears from the screen when you hit the ENTER key after typing RUN.

MERRY HOLIDAY!

The **Total Mind of All TRS-80's That Be** would like to take this occasion to compute a prediction of a happy and prosperous new year for you, subject to the following clarifications: One, that a year is defined as 365.24219879 mean solar days, considered to commence at some point fast approaching; and Two, that due recognition is given the fact that TRS-80's, as all other computers, celebrate the winter solstice (December 21 on the Gregorian calender). Gifts are considered to be in good taste.

(this message brought to you as a cheap promotional stunt by **CLOAD Magazine,** the only TRS-80 cassette magazine in actual existence.)[1]

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CIRCLE 123 ON READER SERVICE CARD

TRS-80, con't . . .

Tahl said he has a "keyboard trick" to make keys repeat. He wrote it in one line; here it is in six lines, to be a little easier to figure out, and also to fit this narrow column:

```
10 A$=INKEY$
20 FOR X=16438 TO 16444
30 POKE X,O
40 NEXT X
50 PRINT A$;
60 GOTO 10
```

Just hold down any key and it will repeat forever.

The program picks up a character in the A$. The FOR/NEXT involves an 8-byte buffer, the keyboard rollover buffer, which stores the last character depressed. If a key is held down, the computer looks in memory, finds the key is still down, and so doesn't repeat it. If there is no match between the rollover buffer and the key held down, the character will be printed. This program zeroes out the buffer to prevent a match.

Tahl and I talked about young software enthusiasts, and he said that Radio Shack doesn't hire programmers under the age of 18.

Tahl has been working for Tandy Systems Design for "a year and a couple of months," and is described by a higher-up as "one of our best systems programmers." He applied for the job on his 18th birthday, last year.

Before any of you hot-shot 18-year-old software fanatics rush to apply for a job with Radio Shack, you should know that Tahl is just about the only person in his department who doesn't have an engineering or computer-science degree. If you're really into chess, the name Tahl may be familiar . . .

Tandy Systems Design, incidentally, designs the hardware and the operating systems. The Radio Shack Computer Applications group writes all the machine-language programs, BASIC programs, and the educational, business and game programs.

Software Catalogs

The 48-page software catalog described in the Nov. column (p. 00) was the Summer catalog of the TRS-80 Software Exchange. Their Fall catalog is 80 pages long!

Creative Computing's new catalog may not be 80 pages long, but it may be the most informative software catalog you'll ever find and it has a more imaginative cover than any other (it's the same as the August 1979 magazine cover).

In these 20 large pages (equivalent to 40 pages of the Software Exchange-size catalog), over 400 programs on 75 tapes and disks are described in detail, many with photographs of the programs on the screen so you'll know what to expect.

Included are 14 TRS-80 Level-II cassettes containing over 55 programs, seven 32K disks with 42 programs and five Level-I cassettes containing over 20 programs.

The other pages contain tapes and disks for Apple II, Sorcerer, PET, Sol-20 and OSI Challenger computers, and also CP/M 8-inch disks and a few books.

Tandy 10 Computer Gone

The Tandy 10 computer (Aug. 1979, p. 120), based on the ADDS System 70 and System 75, has been replaced by the TRS-80 Model II (Aug. 1979, p. 30).

Clearance sales in Radio Shack Computers Centers closed out over a million dollars worth of these business

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REnumber any section of a program, MOve program segments, DElete program lines. Combine programs with renumber and merge. Load or save any portion of program from tape.

DISK SORT PROGRAM 'DOSORT' for $34.95 (Specify 32 or 48K, minimum 2 disk system)
SORT/MERGE multi-diskette sequential files. Multiple variables and keys. Includes machine language in-memory sorts, comparators and string handling.

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CIRCLE 186 ON READER SERVICE CARD

TRS-80, con't . . .

computers. The minimum Tandy 10, with 48K of user RAM and two 8-inch Shugart disk drives, was originally $9,995. Sale price: $5,995.

Hint to Neiman-Marcus

The annual Christmas catalog from Neiman-Marcus (the Dallas-based store where you shop for the person who has everything) usually has at least one unique, exclusive, expensive item. Last year it was a Monopoly board molded in chocolate, with the cards printed on thin slabs of sugar candy, for a trifling $600.

Although it's a little late for Neiman-Marcus to use this year, here's a suggestion for the 1980 catalog: offer a gold-plated Radio Shack TRS-80 Model I with a couple of graphic-art cassettes, to be used as a conversation piece at parties.

The video display could be mounted in the wall, or in a plastic case, with only the screen showing. The keyboard should be concealed, to keep it safe from spilled martinis, dropped hors d'oeuvres and the wandering fingers of plastered party-goers.

The cassettes should be programmed to cycle through the graphics programs automatically, using timing loops to make the displays last five or 10 or 15 minutes each. The timings could be user-selected via a menu to be called up on the CRT before the party, so the host and/or hostess could determine the display times for the various graphics programs, which also would be chosen from a menu.

The cassettes could include programs such as the kaleidoscope described in the Sept. column (p. 186), modified so that A and B are furnished automatically by a random-number generator; Electric Paintbrush (Sept. column, p. 190), preprogrammed with several dozen far-out special effects; and maybe even some special programs written by computer-graphics specialists such as Leo Christopherson, father of the highly imaginative Android Nim (Creative, June 1979, p. 125) and Snake Eggs (to be reviewed here soon).

There are also computer cartoons that could be included in the party cassettes, such as Space Cartoon in the June 1979 issue of CLOAD magazine. This is a brief, clever, animated cartoon involving a spaceship, a landing on a distant asteroid and a curious edifice thereupon.

Y'all listening, Neiman-Marcus? □

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Lower Case for Apple II

The Lower Case Adapter is a plug-in device that expands the normal text display mode to the full 96 character ASC11 set with no modifications to the Apple. Compatable with DOS 3.2 and all printers. Available at your local Apple dealer, or send $49.95 (& $3 sales tax in CA) to:

ENHANCEWARE
by Dan Paymar
Box A-CS 6800
Costa Mesa, CA 92627

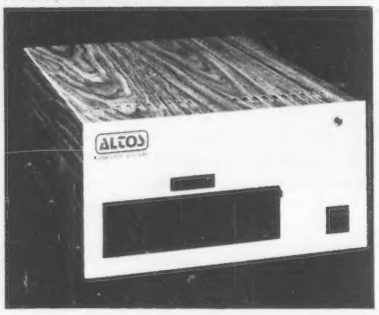
CIRCLE 179 ON READER SERVICE CARD

Compleat Computer Catalogue

We welcome entries from readers for the "Compleat Computer Catalogue" on any item related, even distantly, to computers. Please include the name of the item, a brief evaluative description, price, and complete source data. If it is an item you obtained over one year ago, please check with the source to make sure it is still available at the quoted price.

Send contributions to "The Compleat Computer Catalogue," *Creative Computing*, P.O. Box 789-M, Morristown, NJ 07960.

COMPUTERS



ALTOS SINGLE DRIVE SYSTEM

Altos Computer Systems has announced a Single Drive ACS8000 computer system for applications where a second drive is unnecessary. The single drive systems may be networked, daisy-chained or, as an alternative, radio-networks may be constructed with satellites communicating to a coast Altos hard disk system or larger main-frame (DEC, IBM).

Altos Computer Systems, 2388-A Walsh Ave., Santa Clara, CA 95050. (408) 244-5766.

CIRCLE 225 ON READER SERVICE CARD

SMALL BUSINESS SYSTEM

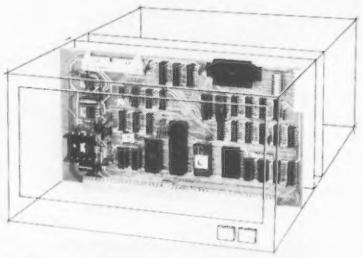
The Series 5000 computer system is announced by Industrial Micro Systems, Inc. It is a combination of many component products previously sold separately by IMS: An 8080 CPU board, 5¼" disk drives, and RAM memories now come together in this system.

In either desk-top or desk enclosure versions, it can accommodate one, two, or three 5¼" floppy disk drives for up to 1 megabyte of storage. With the IMS RAM boards, up to 300 kbytes of main memory can be directly addressed.

Two operating systems are currently available for the Series 5000: The CP/M and the MVT-FAMOS multi-user, multi-tasking system.

Industrial Micro Systems, 628 N. Eckhoff St., Orange, CA 92668. (714) 633-055.

CIRCLE 226 ON READER SERVICE CARD



6809 SS-50 BUS CPU CARD

Percom Data Company announces a 6809 central processor card for the company's SS-50 bus product line. Designated the SBC/9 (Single-Board-Computer/6809), the PC card may be used either as a stand-alone control computer or as an upgrade CPU card for SS-50 bus microcomputers.

The SBC/9 includes its own operating system, called Psymon (Percom System Monitor) in a 1K ROM plus provision for an additional 1K of ROM. It is completely compatible with the existing SS-50 bus, requiring no modification of the motherboard, memory or I/O slots. $199.95.

Percom Data Company, 211 N. Kirby, Garland, TX 75042. (800) 527-1592.

CIRCLE 227 ON READER SERVICE CARD

THE CROMEMCO Z-2H

Cromemco's Z-2H offers an integral 11-megabyte hard disk drive and a wide range of features including a fast Z-80A, 4MHz processor; two floppy disk drives; 64K of RAM memory; an RS-232 serial interface; a printer interface; and a 12 slot motherboard.

Cromemco's extended CDOS operating system is included.

The Model Z-2H is provided with a full 64K of high speed RAM memory using Cromemco's 64KZ RAM memory cards.

Every Z-2H is also supplied with a Cromemco Model PRI printer interface card. $9,995.

Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043. (415) 964-7400.

CIRCLE 228 ON READER SERVICE CARD

I/O AND CPU CARDS FROM MICRODASYS

The Model 8P2SM-C Parallel/Serial I/O card provides 8 parallel bidirectional data ports with full handshaking and interrupt handling. In addition there are two serial input and output ports. The user can configure one set of serial ports for full RS-232 operation, and the other as a full duplex answer or originate MODEM or byte standard cassette interface. Kit, $149; $199 assembled.

The MD-690b CPU card from MicroDaSys brings the 6809 processor with its 16-bit instructions and internal registers, extended addressing and hardware multiplica-

tion to S-100 bus. This single board computer integrates I/O, RAM, PROM cassette interface and other features in a complete package. Kit. $198; $258 assembled.

MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036. (213) 935-4555.

CIRCLE 229 ON READER SERVICE CARD

DESKTOP SYSTEM FROM DEC

A desktop computer system from Digital Equipment Corporation for reduction of laboratory data, the MiniMINC, has graphic capability to represent data. It is built around an LSI version of Digital's PDP-11 computer family and features 64 K byte memory and a dual floppy-disk storage system with a capacity of 512 K bytes.

An analysis tool for scientific, engineering, and management problem solving, the MiniMINC is a full development system for stand-alone operation. It can also be incorporated into a distributed system. Mini-MINC has provisions for up to three serial line inputs: instrument data in serial form are readily accepted and processed. MiniMINC is compatible with Digital's larger MINC laboratory computer system. $9,900.

Digital Equipment Corporation, Maynard, MA 01754.

CIRCLE 230 ON READER SERVICE CARD

MISCELLANEOUS

PROGRAMMING PROBLEMS AND KEYBOARD POSTER

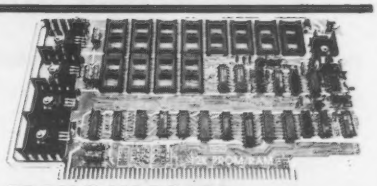
Two sets of programming problems are available which are appropriate for beginning programming students in Grades 5 to 12. Each problem is on a heavy, colored 5½x8½" card; most have illustrations. The first set, called "Computer Conversations" has 41 problems and costs $4.95. The second set, "More Computer Conversations" has 27 problems and costs $3.50; a teachers guide is $2.95.

A large 23x29" poster contains an oversize diagram of a Model 33 Teletype keyboard. $2.95.

The Math Group, Inc., 396 East 79th St., Minneapolis, MN 55420.

CIRCLE 231 ON READER SERVICE CARD

MEMORY



PROM/RAM BOARD

Vector Graphic Inc. has announced its S-100 bus PROM/RAM board featuring a PROM programming capability for creating customized software programs. The board accommodates up to 12K of 2708 or 2704-type programmable read-only memory with 1K of 2114 static RAM. Addressing is controlled by jumper options and special circuitry is incorporated for the reset-and-go function and to generate MWRITE.

An on-board sliding switch allows one of the PROM sockets to be converted to a PROM-programming socket. To facilitate operation, an assembly language program is provided which permits the transfer of data from memory to an erased PROM in the programming socket. $215.

Vector Graphic Inc., 31364 Via Colinas, Westlake Village, CA 91361. (213) 991-2302.

CIRCLE 232 ON READER SERVICE CARD

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BOOKS AND BOOKLETS

SYSTEMS DYNAMICS IN EDUCATION

"Systems Dynamics in Education" introduces teachers to one form of computer simulation.

Part I of the booklet describes how system dynamics can be used to supplement and integrate biology, social sciences, mathematics, and other subjects. Part II discusses the DYNAMO simulation language which can simplify the teaching and use of simulation.

Part III provides several short examples of computer models applied to biology and other disciplines. Part IV is an annotated bibliography of materials appropriate for high school and undergraduate curricula. $1.00.

Pugh-Roberts Associates, 5 Lee St., Cambridge, MA. (617) 864-8880.

CIRCLE 233 ON READER SERVICE CARD

COMPUTER JOBS

Compjob is a very useful 75-page book about building a career in the computer world. It has 17 pages of questions and answers about advantages and disadvantages of big and small companies, educational requirements, salaries, job hopping, training and resumes. The remainder of the book contains an alphabetical listing and brief description of 115 major employers in the EDP field. (There are two curious omissions: Creative Computing — obviously not major enough and AT&T/Bell Labs/Western Electric — very major and one of the largest EDP employers in the country). A useful book for the job seeker. $6.95 postpaid.

Employment Information Services, P.O. Box 3265, Chico, CA 95927.

CIRCLE 262 ON READER SERVICE CARD

TRS-80 SOFTWARE SOURCE LIST

The latest edition of the TRS-80 Software Source Directory lists over 5,000 TRS-80 software programs from over 380 vendors.

The TRS-80 Software Source Directory is designed to be used in the home, educational, personal and professional areas by the TRS-80 user. It has been referred to as the biggest and the most comprehensive software directory in the micro industry. The first two editions were a complete sell out and the latest edition is expected to do the same.

The Directory is published in the following format: programs alphabetized by title, by Basic, by vendors, by category, by cassette/disk, vendor's name, address, and phone. $6.00

ComputerMat, Box 1664, Lake Havasu, AZ 86403. (602) 855-3357

CIRCLE 234 ON READER SERVICE CARD

GUIDE TO TESTING SYSTEMS AND BOARDS

A free, 24-page booklet describing the unique test problems and solutions associated with microprocessor-based systems is now available from Millennium Systems, Inc. Entitled "Guide to Testing Microprocessor-Based Systems and Boards," the booklet explains why contemporary MPU systems are more difficult to test than older systems, and analyzes the unique properties of MPU systems and defines production testing and field service requirements.

Millennium, 19020 Pruneridge Ave., Cupertino, CA 95014. (408) 996-9109.

CIRCLE 235 ON READER SERVICE CARD

BEST OF PERSONAL COMPUTING

Comprehensive check writing and accounting, stock market analysis, inventory control and vacation planning are a few of the 32 computer programs available in Vol. I of "The Best of Personal Computing".

Compiled from two years' issues of Personal Computing magazine, the program listings are designed to run on many of today's popular microcomputer systems. $7.50.

Personal Computing, 1050 Commonwealth Ave., Boston, MA 02215.

CIRCLE 236 ON READER SERVICE CARD

FREE NASA EDUCATIONAL MATERIALS

The National Aeronautics and Space Administration periodically publishes reports of their various projects, posters, and tutorial guides. NASA is involved in the life sciences, earth sciences and humanities as well as mathematics and the physical sciences. Educators may receive these materials free.

Education Services, NASA (LFG-9), Washington, DC 20546

CIRCLE 237 ON READER SERVICE CARD

REVISED BASIC MANUAL

Deerfield Academy announces its revised edition of **Basic Computing: An Introduction To Programming in BASIC.** Written expressly for those who suffer from "computer anxiety," it is a step-by-step written back-up for the purpose of encouragement during early stages of the learning process.

Also included are exercises sophisticated enough to prevent boredom of early intermediates. $1.75.

Robert P. Hammond, Deerfield Academy, Deerfield, MA 01342. (413) 772-0241.

CIRCLE 238 ON READER SERVICE CARD

"BENCHMARK REPORTS"

Complete information about ACU's Benchmark Report series is featured in a free six-page brochure offered by the Association of Computer Users. The Benchmark Report is a monthly, 24-page report comparing popular computer systems.

It is designed to provide impartial comparisons to decision makers who have computer selection responsibility.

Association of Computer Users, P.O. Box 9003, Boulder, CO 80301. (303) 499-1722.

CIRCLE 239 ON READER SERVICE CARD

INDEX FOR LEVEL II MANUAL

Graves Manufacture and Service announces a supplemental index for the Radio Shack Level II Basic Reference Manual.

The index has the contents of the Level II Reference Manual listed in alphabetical sequence with one hundred twenty line items. $2.00.

Graves Manufacture and Service, P.O. Box 306, Lake Bluff, IL 60044.

CIRCLE 240 ON READER SERVICE CARD

AUERBACH/INFOTECH STUDY ADDRESSES MAN/COMPUTER COMMUNICATION

Infotech International has announced 'Man/Computer Communication,' the fifth in the 1979 series of computer state of the art reports.

Significant Invited Papers pursue such areas as: the personal computer in the office of tomorrow; natural language; using speech to communicate with machines; coping with the 'casual user'; and the psychology of the man/computer interface.

Auerbach Publishers, Inc., 6560 North Park Dr., Pennsauken, NJ 08109. (609) 662-2070.

CIRCLE 241 ON READER SERVICE CARD

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- **COMMODORE #2040 CBM DUAL FLOPPY DISK with PET to IEEE CABLE,** *sells for* ..... $1,325.
- **$200. WORTH OF PET SOFTWARE (List to select from),** *was list @* $ 200.
- ***NEW* CmC (CONN. MICRO. COMPUTING) 32K WORD PROCESSING PROGRAM MODIFIED FOR DISK VERSION BY COMPUTER STRATEGIES. NEW VERSION CONTAINS TAB FUNCTION, AUTO JUSTIFICATION AND MANY NEW FEATURES,** *was list @* ..... $ 75.
- ***NEW* CmC ADDRESSABLE IEEE TO RS 232 INTERFACE** *was list @* ..... $ 180.
- **FULL YEAR WARRANTY/SERVICE CONTRACT ON CPU. (that is 9 months longer than factory)** *was valued @* ..... $ 174.

TOTAL COST OF ABOVE ..... **$3,344.**

SPECIAL PACKAGE PRICE ..... **$2,940.**

(SAVINGS OF $404.00)

Word Processing Printers such as DEC/LA34 or DIABLO DTC302 available at good prices.

WITH SPECIAL PACKAGE YOU GET

- 60 hour Burn In/Stress Test of all CPUs done prior to shipping
- Turn around on all repairs in 36-48 hours.
- We give you our devoted attention, as Commodore is the ONLY Computer we sell. We respond to your requests.

OTHER PACKAGE SYSTEMS SUCH AS HOBBYISTS, HAM RADIO OR BEGINNERS PAK ARE ALSO AVAILABLE @ SPECIAL SAVINGS.

- ☐ **We also SELL used 8K PETS for $568.** *Including* **$100. worth of free software.**
- ☐ ***NEW* BASIC PROGRAMMER'S TOOL KIT for 16/32K PETS available at $46.50 including shipping.**
- ☐ **MICROTRONICS "HAM RADIO" INTERFACE (RTTY/CW) AT SPECIAL LOW DISCOUNTED PRICE. SPECIAL DX-DATA RECALL/LOGGING PROGRAMS AVAILABLE.**
- ☐ **UPDATE YOUR OLD 8K PET TO A NEW 2001-32K FULL SIZE KEYBOARD FOR $635.00 PLUS YOUR WORKING 8K UNIT. ALSO INCLUDED IS $100.00 WORTH OF FREE USER SELECTED SOFTWARE.**

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- We are a Direct Authorized Commodore Dealer
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CIRCLE 133 ON READER SERVICE CARD

IBM Buys Qume. Now You Can Too!

The Qume Sprint 5 Daisywheel Terminal.

FAST. At 55 characters per second the fastest daisywheel printer made.

SMART. The Qume Sprint 5 is *the* printer for word processing and plotting because microprocessor controlled Sprint 5 logic responds to all 128 ASCII codes plus 43 Qume-defined commands for specific paper handling and carriage movement controls. That means it supports bidirectional printing, proportional spacing, right justification and high resolution graphics (5760 points per square inch).

FLEXIBLE. A variety of configurations guarantees there is a Sprint 5 for you, whether you have a TRS-80, an IBM 370 or anything inbetween.

- Keyboard (KSR) or Receive Only (RO)
- RS-232C, DC Current Loop or Parallel Interface
- 45 or 55 characters per second

A multitude of daisywheels (over 70) in various typestyles, pitches and language variations plus a colorful rainbow of carbon and fabric ribbons gives you a dynamic range in the appearance of your letter perfect printouts.

Reconditioned Qume-based Daisywheel Terminal was $4500+, now $2150.

Gen Com's 300Q Qume Terminal, fully reconditioned

- Qume Q30 print mechanism (30 cps)
- Bidirectional printing/proportional spacing
- Plotting—Super Plot firmware package standard
- 1/120" horizontal control, 1/48" vertical control
- Wheeled pedestal standard
- 86 key keyboard w/15 key numeric pad
- RS-232C serial interface, cable included
- ASCII encoded w/256 character buffer
- 30 day limited warranty
- Nationwide service

Qume Sprint 5:	55 CPS, KSR	$3295
	45 CPS, KSR	2995
	55 CPS, RO	2895
	45 CPS, RO	2695
Gen Com 300Q		2150
DTC 300A (similar to Gen Com 300Q, but w/Hytype I mechanism)		1995
Uni-directional Forms Tractor		210
Bi-directional Forms Tractor		250
Cut Sheet Feeder		1390
Pin Feed Platen		160
TRS-80 interface (for any above terminal)		49.95
Electric Pencil Word Processing Software (TRS-80 version-cassette)		99.95
Electric Pencil Word Processing Software (TRS-80 version-disk)		150
Daisywheels and Ribbons (Qume and Diablo)		write for list

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VENDOR LITERATURE

EDUCATIONAL SOFTWARE CATALOGUE

A mail order catalogue devoted exclusively to Educational Software for personal computers is being published by Queue.

The catalogue will contain educational software listings which will be separated by educational level and field, and by computer.

Queue, 5 Chapel Hill Dr., Fairfield, CT 06432. (203) 372-6761.

CIRCLE 242 ON READER SERVICE CARD

PIPS FOR VIPS

Aresco has announced the release of PIPS for VIPs. Pips contains 160 pages of programs and documentation written for use on the RCA Cosmac VIP, and an appendix describing modifications which can be made to the ELF computers to allow the PIPS programs to be run on those systems. $19.95.

Aresco, P.O. Box 1142, Columbia, MD 21044.

CIRCLE 243 ON READER SERVICE CARD

HEATHKIT CATALOG

A 104-page catalog describing the latest in electronic kits is now available free from Heath Company.

New products featured in the Fall catalog include a five-antenna coax switch for Hams, a new deluxe digital multimeter, a car thermometer, a series of self-instruction math programs and an educational program entitled, "Computer Concepts for Small Business."

Heath Company, Dept. 350-930, Benton Harbor, MI 49022.

CIRCLE 244 ON READER SERVICE CARD

HOBBY WORLD CATALOG

The New Hobby World Computer Accessory Catalog #112 contains 16 pages of software, computer boards, systems, printers, semi-conductors, and PC aids designed to meet the needs of the computer enthusiast, novice, and business person. The catalog describes each product in detail. Quantity and club discounts are available.

Ms. Goist, Hobby World Electronics, 19511 Business Center Dr., Northridge, CA. 91324. (213) 886-9200 or (800) 423-5387.

CIRCLE 245 ON READER SERVICE CARD

FREE MISCO CATALOG

The new, expanded fall-winter issue of the MISCO Minicomputer Supplies & Accessories Catalog is available immediately, and offers many new products of interest to computer users. Among the featured items are CRT tables and turntable, computer room anti-static products, media shippers and mailers, several additional storage units, and a filing system for flexible disks.

MISCO Inc., 963 Holmdel Rd., Box 399L, Holmdel, NJ 07733. (201) 946-3500.

CIRCLE 246 ON READER SERVICE CARD

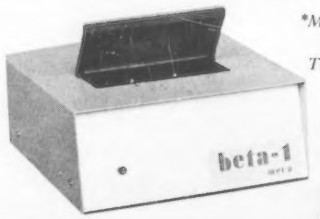
beta-1: A DIGITAL TAPE SYSTEM WITH THE FEATURES OF DISK.

Now there is a low cost alternative to Disk. . . the BETA-1 Tape System.

See the BETA-1 and discover the power of a professional Digital Tape System. (Please don't compare a *Digital Tape System* to an *Audio Cassette Recorder——the similarity ends with the media used.)* The BETA-1 Digital Tape System not only provides mass storage (more than 10 times the storage per dollar than Disk), but also provides high reliability—equivalent to floppy disk.

COMPARE THESE ADVANTAGES

• File handling capabilities (direct access at 100"/sec.) with full computer control. • Record handling capabilities—a must for business applications. • Data rate at 4000 bits/sec. standard. This is more than 10 times faster than most audio cassette recorders. Higher data rates are optionally available. • 500,000 Bytes, formatted, storage per drive. 1,000,000 bytes optional. Can be purchased as a system of 1-4 drives, providing up to 4 million bytes on line at a fraction of disk storage cost. • Hardware and software interface packages are available for most popular microcomputers, like **TRS-80*, SORCERER*, and APPLE*.**



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delta-1: OVER 4 TIMES THE STORAGE

The Double-Density, Double Sided Mini Floppy For S-100 Bus Owners!

COMPARE MECA's COST AND CAPACITY

The DELTA-1 has 30% greater capacity for 18% less cost than Micropolis and 13% greater capacity for 15% less than North Star.

Included with the DELTA-1 Disk System is an S-100 bus, MFM encoding controller card, from one to three 5¼" disk drives, power supply, case, cable, disk operating system, the powerful Tarbell Disk BASIC, and manual. Price of double-sided disk system is $925. Optional software available includes CP/M* and Microsoft Disk BASIC.

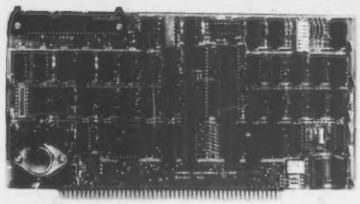
For complete information, phone or write:

meca

7026 O.W.S. Road., Yucca Valley, Ca 92884 • (714) 365-7686

CIRCLE 162 ON READER SERVICE CARD

FLOPPY DISCS



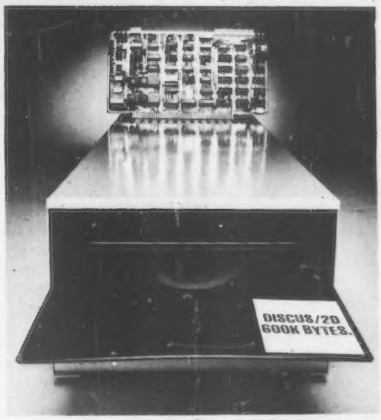
DOUBLE DENSITY FLOPPY DISK INTERFACE

Tarbell Electronics has released its Double Density Floppy Disk Interface, a component which promises to enhance existing disk storage capacities with minimum reconfiguration of existing microcomputer systems.

The interface board is supplied with Basic Input/Output System software for CP/M on single-density diskette, permitting the user to intermix single and double density diskettes. The Tarbell system automatically determines whether single or double density is in use. As many as four drives can be selected, using either single or double density. $425.

Tarbell Electronics, 950 Dovlen Pl., Suite B., Carson, CA 90746. (213) 538-4251.

CIRCLE 247 ON READER SERVICE CARD



S-100 COMPATIBLE DISK SUB-SYSTEMS

Thinker Toys announces the availability of three S-100 compatible 8″ full-sized floppy disk subsystems: The Discus 2+2 is a quad density floppy disk system capable of storing up to 1.2 megabytes of data using the IBM compatible soft-sectored format and the newly available double-sided floppy disk drives.

The Discus 2D is a double density floppy disk system with a capacity of 600K bytes also using the soft sectoring IBM format and a single sided 8″ floppy disk drive.

The Discus 2D S-100 compatible controller is used with both systems and includes a serial I/O port with a UART and programmable baud-rate generator.

The Discus I is a single density system with a capacity of 250K bytes of storage again using the IBM soft sectored format. The Discus I system uses the Disk Jockey I single density S-100 compatible controller.

Thinker Toys, 5221 Central Ave., Richmond, CA 94804. (415) 524-2101.

CIRCLE 248 ON READER SERVICE CARD

MAGAZINES, JOURNALS

COMPUTERS IN PSYCHIATRY/PSYCHOLOGY

The Newsletter on Computer Applications in Psychiatry and Psychology is an informal, scientific newsletter for mental health professionals interested in this area of computer applications.

Computers in Psychiatry/Psychology (formerly Micro-Psych) is a bimonthly 13-page letter indicating work being done and program availability. A year's subscription is $15.

Computers in Psychiatry/Psychology, 26 Trumbull St., New Haven, CT 06511.

CIRCLE 249 ON READER SERVICE CARD

TRS-80 LEVEL II

$750. COMPLETE SYSTEM

The world's most popular microcomputer, with 16K of memory and Level 11 basic for only $750, complete with full 90 day Radio Shack warranty. We accept check, money order or phone orders with Visa or Master Charge. (Shipping costs added to charge orders).

Disk drives, printers, peripherals, software and games . . . you name it, we've got it (Both Radio Shack & other brands). Write or call for our complete price list.

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VERBATIM® ATHANA® BASF®

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8″ Floppies only $3.20 ea. HUNDRED LOTS

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5¼″ Mini-floppies only $2.60 ea. HUNDRED LOTS

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SPECIFY SIZE, TYPE, & COMPUTER

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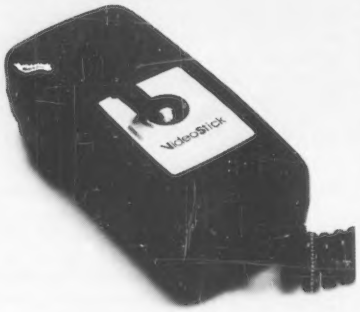
PERIPHERALS



APPLE JOYSTICK

ISC, Incorporated, introduces the Model VS20/APL "Videostick" X-Y controller for the Apple II. The unit features a large push (firing) button and a high quality, long life linear joystick designed specifically for video applications such as plotting graphics or playing games.

The controller plugs directly into the Apple II and can be hand held or table positioned. $39.95.

Computer Plus, Incorporated, 1324 South Mary, Sunnyvale, CA 94087.

CIRCLE 250 ON READER SERVICE CARD

C-LOADER FOR TRS-80

The C-LOADER is designed to eliminate CLOAD and CLOAD? problems encountered in many TRS-80 computers. It connects between the jack of the cassette deck and the cable to the TRS-80 keyboard. It does not require any electrical power or batteries and no tools are needed for installation.

C-LOADER allows the user to CLOAD tapes and verify dumps with CLOAD? at any volume setting of the deck above a minimum level. $12.95.

GB Associates, P.O. Box 3322, Granada Hills, CA 91344.

CIRCLE 251 ON READER SERVICE CARD

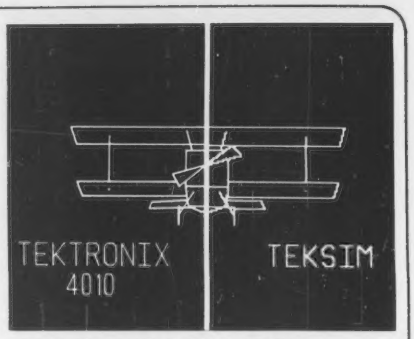
AC REMOTE CONTROL SYSTEM FOR COMMODORE

Honders Inc. offers a complete home or office AC remote control system for the Commodore PET or CBM. Virtually any electrical device can be switched on or off and lamps can be dimmed or brightened under computer control.

The basic package includes a plug-in module to the Commodore's IEEE bus interface, two remote power controllers and a complete cassette software package for demonstrations and applications. $179.

Honders Inc., Kennel Rd., Cuddebackville, NY 12729. (914) 754-7106 or (212) 765-0815.

CIRCLE 252 ON READER SERVICE CARD



TEKTRONIX SIMULATOR FOR APPLE

A new ROM-based device which enables an Apple II Computer to emulate Tektronix 4010-series graphics terminal has been introduced by ABW Corporation.

Teksim, the "Tektronix Simulator", employs distributed processing in its programming approach and uses Apple's high resolution plotting capabilities. No modification to the host-resident program is required to display or input graphical data.

Cybersoft Systems, 301 S. Livernois, Rochester, MI 48063. (313) 652-9008.

CIRCLE 253 ON READER SERVICE CARD

Z-80/TRS-80™ Users
BOOK YOU'VE WANTED NOW CAN BE YOURS
THE Z-80: HOW IT WORKS
(THE PROGRAMMERS PERSPECTIVE)
By Monte Corum
Best Most Complete Reference Yet
cpu Operation Explained
Addressing Modes Demystified
Register Functions Described
Instructions Defined
Interrupts Diagrammed
Cycles Outlined Formats Described
Execution Described in Text,
Notation and Diagrams
Meaningful Analysis of 698 Commands
in Formatted, Usable Tables
Simple, Consistent Notation and Formats
A Programmer's Book, Beginner or Experienced
Ideal Text for Class Instruction
Pricse: $17.95 Plus Tax and Shipping
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MICROWARE ASSOCIATES, INCORPORATED
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SCOTTSDALE, AZ. 85253
DEALER INQUIRIES INVITED
™ TRS-80 IS A TRADEMARK OF TANDY CORP.

CIRCLE 169 ON READER SERVICE CARD

Mike's
announces
North Star Horizon Timesharing
with
Hard Disk Interface

In excess of 120 megabytes bulk storage capacity now possible. Several different hard disk units are available, interfaced to North Star DOS and BASIC.

Two to seven-user timesharing North Star Horizon integrated computer systems with: Dual density or quad capacity eight inch drives and/or hard disk units with your choice of a variety of printers.

A complete selection of innovative business application software is available for North Star★ systems.

Foreign orders are our specialty.
Dealerships are available. Call or write for descriptive literature, hard disk availability and/or dealer information package.

Micro Mike's, Incorporated
905 South Buchanan ★ Amarillo, Texas 79101 ★ USA
Telephone: 806-372-3633
making technology uncomplicated — for People

CIRCLE 168 ON READER SERVICE CARD

New From ECI

- **Selectric I/O Interface Controller**—For IBM Selectric I/O typewriters. Uses standard parallel port driver. Automatic case control. (Some typewriter modification may be required.) Less connectors. With full instructions. **$289.00**
- **Cassette to Parallel Converter**—Use with Selectric I/O interface to run a typewriter or other parallel device from your cassette output. Works with T-BUG or similar monitor program. Software listing supplied. **$69.95**
- **AGC Box**—Provides constant cassette output regardless of tape level. End loading error problems. Includes tape deck control switch and data indicator. **$29.95**
  Dual unit for two recorders. **$39.95**
- **I.C. Tester**—Tests most common TTL and CMOS I.C.'s. Convenient bench-top module. **$199.95**
- **Universal PROM Programmer**—Bench-top unit programs most PROMS. Keyboard entry with memory and type select switches. **$999.00**

Will accept: Master Charge, Visa or COD

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CIRCLE 149 ON READER SERVICE CARD

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NEW YORK'S ONLY TOTAL COMPUTER CENTER

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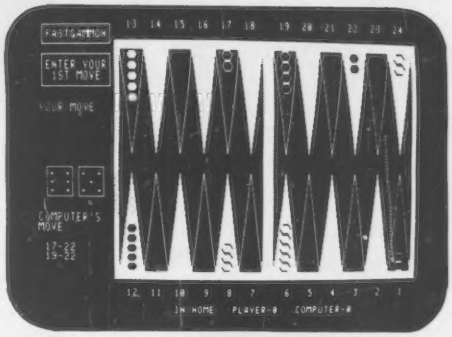
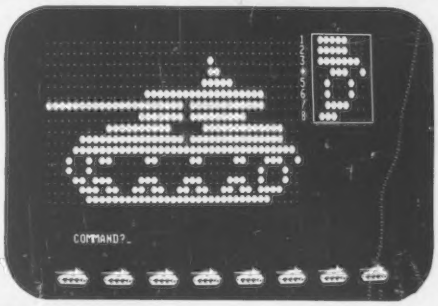
SORCERER* SOFTWARE!

All programs on cassette
Only 8k of memory required.


FASTGAMMON
ENTER YOUR 1ST MOVE
YOUR MOVE
COMPUTER'S MOVE
17-22
15-22
13 14 15 16 17 18 19 20 21 22 23 24
12 11 10 9 8 7 6 5 4 3 2 1
IN HOME PLAYER-0 COMPUTER-0

FASTGAMMON™ by Bob Christiansen. Thousands of people are already playing FASTGAMMON on TRS-80 and Apple. Now it is ready for SORCERER, with the sharpest graphics ever! Backgammon players love this machine language program that provides a skillful opponent. Eight-page instruction manual includes rules of backgammon. **$19.95**



SHAPE MAKER™ by Don Ursem. Construct special characters and fancy shapes with ease using this on-screen character editor. Detailed 12-page instruction booklet includes example applications. **$14.95**

PLOT by Vic Tolomei. Now Apple owners will be envious of how easy you can get good graphics on your SORCERER. PLOT includes both a super high resolution mode and a quick low resolution mode. Both are accessible from your BASIC programs using simple commands. Hi-res & lo-res examples included on tape. **$14.95**

DEBUG by Bob Pierce. Debug machine language programs by stepping through one instruction at a time. Relocatable. Several display options. Multiple break points. Modify memory and registers. **$14.95**

Z-80 DISASSEMBLER by Vic Tolomei. Decode machine language programs, including SORCERER'S monitor and ROM-PACs, with this Z-80 Disassembler written in BASIC. Instruction mode prints out machine code and Zilog mnemonics in standard format. Or use the ASCII mode which coverts machine code to ASCII. **$14.95**

MAGIC MAZE™ by Vic Tolomei. A challenging maze game. Ten levels of play. Holding your lantern, you wander through a maze trying to stay on the right path and avoid pitfalls. Automatic scoring tells you how good a pathfinder you are. **$11.95**

SOFTWARE INTERNALS MANUAL FOR THE SORCERER by Vic Tolomei. A must for anyone writing software for the SORCERER. Seven chapters: Intro to Machine Language, Devices & Ports, The Monitor, Cassette Interface, BASIC structure, Video & Graphics, The Keyboard. Indexed. Includes diagrams and software routines. 64 pages. **$14.95**

QS **QUALITY SOFTWARE**
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Telephone 24 hours, seven days a week: (213) 344-6599

WHERE TO GET IT: Ask your nearest Sorcerer dealer to see *Quality Software's* Sorcerer programs. Or, if you prefer, you may order directly from us. MasterCharge and Visa cardholders may telephone their orders and we will deduct $1 from orders over $19 to compensate for phone charges. Or mail your order to the address above. California residents add 6% sales tax. Orders outside North America add $5 for registered airmail, pay in U.S. currency.

* The name "SORCERER" has been trademarked by Exidy, Inc.

CIRCLE 167 ON READER SERVICE CARD

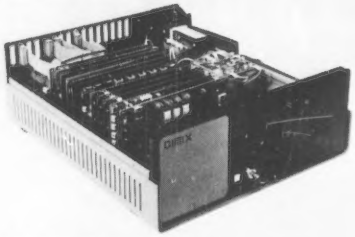
A.C. POWER CONTROL for ALL COMPUTERS or COMPLETE TURNKEY SYSTEMS

Interface TO the Real World with GIMIX Relay Driver Boards. Connects to any Computer through a 20 ma. current loop (up to 4 Boards - 128 Relays per port).

Interface FROM the Real World with GIMIX

★ OPTO BOARDS (up to 34 switch closures with one 8 bit Parallel I/O Port)
★ 16 BUTTON KEYPADS
★ 35 BUTTON ALPHANUMERIC KEYPADS

A Broad Range of 6800 Systems and Boards Compatible with the SS50 Bus



MAINFRAME: Includes chassis, power supply, switches, fan and mother board . . **$ 798.19**

16K SYSTEMS: Mainframe, plus 6800 CPU, 16K Static Ram and choice of I/O **$1344.29**
Other packages available.

16K Static RAM Boards for the SS-50 Bus

- Gold bus connectors
- 4 separate 4K Blocks
- Individual Addressing, Write Protect, and Enable/ Disable for each block

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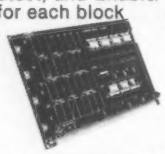

As above with Sockets and Software control features
$368[16]

All GIMIX memory boards are assembled, Burnt-In for 2 weeks, and tested at 2 MHz.
Add $32.00 for 250 ns parts

TI TMS 4044's — 10% SUPPLY
(Not an "equivalent", but the real thing!)

450 ns	**$5.90** each	250 ns	**$6.90** each
8KPROM BOARD			**$ 98.34**
4K PPD PROM BOARD, Burner and Duplicator			**198.35**
2708's		each	**7.90**
64 or 32 x 16 VIDEO BOARD			**198.71**
80 x 24 SUPER VIDEO BOARD with user programmable RAM character generator			**458.76**
Serial I/O's	1 Port **$ 88.41**	4 Port	**198.43**
Parallel I/O's	2 Port **$ 88.42**	8 Port	**198.45**

Add $5. handling charge on orders under $200.

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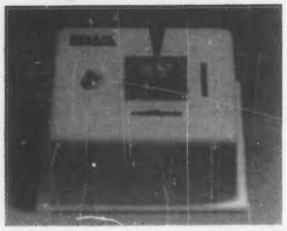
Quality Electronic products since 1975.

CIRCLE 152 ON READER SERVICE CARD



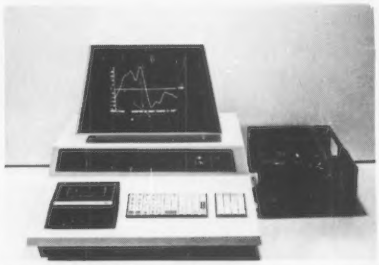
PAIA/APPLE II JOYSTICK CONTROLLER

PAIA announces the PAIA/Apple II Joystick Controller. It features plug compatibility with Apple II's game I/O connector, precision gimbaled self-centering action and case style and color consistent with the Apple II.

Other features include front panel trimmers for X and Y axis outputs and a capacitively activated closure to the Apple II's SWO input which operates with only a finger's touch of the controller's metal shaft. Closure to Apple II's SW1 input is activated with a standard push-button. $65.

PAIA Electronics, Inc., 1020 Wilshire Blvd., Oklahoma City, OK 73116.

CIRCLE 254 ON READER SERVICE CARD



HIGH RESOLUTION GRAPHICS FOR PET

The Micro Technology K-1008A-P Visible Memory is a graphic display board that upgrades the Commodore Pet computer system to permit high resolution graphics, such as math plots, 3-D line drawings in perspective, and arbitrary character sets.

The board interfaces to the PET with the K-1007A-1 bus adaptor with easily detached ribbon cable interconnects. Without bus adaptor, the K-1008A-P can be used with AIM-65, KIM-1 and SYM-1 computers.

The K-1008A-P Visible Memory is priced at $243, the K-1007A-1 bus adaptor at $99, the K-1005A-P card file at $80, and the K-1008-3C software at $20.

Micro Technology Unlimited, 841 Galaxy Way, P.O. Box 4596, Manchester, NH 03108. (603) 627-1464.

CIRCLE 255 ON READER SERVICE CARD

ADAPTER REDUCES DATA READ ERRORS

Percom Data Company offers a plug-in adapter for the TRS-80 and Southwest Technical Products MP-F mini-disk controllers which it says will eliminate the data read errors caused when clock and data bits are not reliably separated during playback.

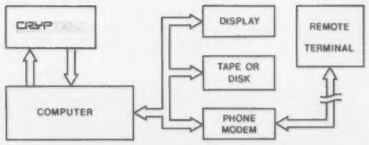
Called the Separator, the adapter may be installed without making any changes to the host system.

It uses an external data separation circuit that features special circuitry to compensate for a phenomenon referred to as "bit shifting." $29.95.

Percom Data Company, 211 N. Kirby, Garland, TX 75042. (800) 527-1592.

CIRCLE 256 ON READER SERVICE CARD

CRYPTEXT



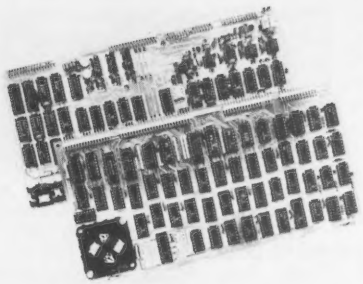
ENCRYPTION DEVICE FOR TRS-80

Cryptext is a hardware encryption device designed to plug directly into the back of the TRS-80 or into the expansion interface via an optional cable.

The Cryptex device allows business users and computer hobbyists to secure virtually any data, including inventory and financial data, technical and proprietary information, graphics, programs or text. The encrypted information can be stored on cassette tapes or on disks, secure against unauthorized access. $299.

Cryptext Corporation, P.O. Box 425, Northgate Station, Seattle, WA 98125.

CIRCLE 257 ON READER SERVICE CARD



CROMEMCO SUPER DAZZLER

The Cromemco Super Dazzler Interface is a high-resolution graphics interface designed for use in Cromemco computer systems. The Super Dazzler Interface (SDI) can be used to display color or black-and-white images with up to 756 by 484 point resolution. Its circuitry is contained on two cards.

The SDI uses direct memory access to display the contents of a display memory. It has three separate analog output signals to drive the red, green and blue guns of a high-quality RGB monitor. $595.

A two-port memory card has been developed for use with the SDI. Picture information is accessed by the SDI through a connector on the top of the cards. Three 16K two-port memories hold a full 48K picture, and use of the two-port memory for the display memory assures 75% to 100% CPU utilization, depending on the application software. $795.

Cromemco, Inc., 280 Bernard Ave., Mountain View, CA 94043. (415) 964-7400.

CIRCLE 259 ON READER SERVICE CARD

LIGHT PEN AND PICK MODULE

Megatek Corporation has announced the availability of a light pen and pick-module for use with its Whizzard 7000 series of vector refresh graphic terminals and systems. The light pen and pick-module feature automatic highlighting to provide the user with real-time feedback while working at the Whizzard display.

The light pen's built-in highlighting feature causes any vector or character to blink when the user points to that item on the screen with the light pen.

The pick-module is essentially a digital light pen which can be tied to either joystick or digitizer inputs.

Megatek Corporation, 3931 Sorrento Valley Blvd., San Diego, CA 92121. (714) 455-5550.

CIRLCE 260 ON READER SERVICE CARD

SIMPLE II DIGITIZER

Talos Systems, Inc. announces The Simple II, a digitizer for systems with graphics applications ranging from medical analysis to interactive graphics to engineering design. The Simple II is an 11″x11″ totally self-contained digitizer with 400 lines per inch resolution and 10 mil accuracy.

X-Y output is variable up to 240 coordinate pairs per second. $1065.

Talos Systems, Inc.

CIRCLE 261 ON READER SERVICE CARD

Creative's own outrageous **Bionic Toad** in dark blue on a light blue shirt for kids and adults.

Computer Bum — black design by cartoonist Monte Wolverton on gray denim-look skirt with black neckband and cuffs.

I'd rather be playing spacewars — black with white spaceships and lettering.

Plotter display of **Pi to 625 Places** in dark brown on a tan shirt.

Creative Computing — Albert Einstein in black on a red denim-look shirt with red neckband and cuffs.

T-shirts available in adult sizes S, M, L, XL; and in children's sizes (Bionic Toad and Spacewar) S, M, L. When ordering, specify design and size. Made in USA. $5.00 postpaid in USA; $6.00 postpaid, foreign.

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Morristown, NJ 07960

creative computing

CIRCLE 218 ON READER SERVICE CARD

FREE! up to $170 in merchandise with the purchase of PET—CBM item!!!

		FREE MERCH.
PET 16K Large Keyboard	$ 995	$130
PET 32K Large Keyboard	$1295	$170
PET 8K	$ 795	$100
PET 2040 Dual Disk *(343K)*	$1295	$170
PET 2023 Printer *(pres feed)*	$ 849	$110
PET 2022 Printer *(trac feed)*	$ 995	$130

KIM-1 $159 (Add $30 for Power Supply)		SYM-1	$222.00
6500 Programming Manual			6.50
2114 L 450 ns	5.70	24/5.15	100/4.45
2716 EPROM (5 Volt)			39.00
6550 RAM *(for 8K PET)*			12.70
6502 Microprocessor Chip			9.75
6522 VIA			9.75
6520 PIA			5.50
PET 4 Voice Music Board (MTUK-1002-2)			$ 45.00
Music Software (K-1002-3C) for PET			$ 16.00
Programmers Toolkit - PET ROM Utilities			$ 45.00
Microchess 2.0 for PET or APPLE			17.90
PET Word Processor - Machine Language			24.00
3M "Scotch" 8" disks	SALE		10/$31
3M "Scotch" 5" diskettes			10/$35
Verbatim 5" diskettes			10/$27

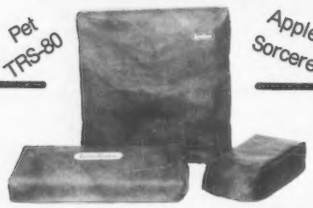
Cassettes *(all tapes guaranteed)*
Premium quality, high output lownoise in 5 screw housing with labels: AGFA PE 611
C-10 10/5.95 50/25.00 100/48.00
C-30 10/7.00 50/30.00 100/57.00
WRITE FOR 6502 AND S-100 PRODUCT LIST

A B Computers 115 E. Stump Road Montgomeryville, PA 18936 (215) 699-8386

CIRCLE 101 ON READER SERVICE CARD

CompuCover®

Pet TRS-80 Apple Sorcerer



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*With expansion interface add $3.00
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PET $15.95 APPLE II $9.95 (Keyboard only)
SORCERER $9.95 APPLE II DISK $3.95
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CIRCLE 124 ON READER SERVICE CARD

INTRODUCING HEWLETT-PACKARD'S HP-41C. A CALCULATOR. A SYSTEM. A WHOLE NEW STANDARD.

The new HP-41C from Hewlett-Packard is a powerful programmable calculator that features: an LCD display with alphanumeric capability; 63 registers of data storage or up to 400 lines of program memory—expandable to 319 registers or up to 2,000 program lines; up to 6 levels of subroutines; 10 conditionals and 56 internal flags; specific loop control; indirect addressing; local and global branching; Continuous Memory; RPN logic.

And when you need them: Memory Modules—plug-in modules for storing programs and data; an "extra smart" Card Reader; a Printer that prints upper and lower case alpha plus special characters and does high resolution plotting; the Wand to input programs in bar code form (available early 1980); Application Modules—preprogrammed, plug-in modules that give solutions to a wide range of problems.

The HP-41C lets you reassign any standard function, any programs you've written, or programs provided in the Application Modules—to any keyboard location you want. And of course Hewlett-Packard backs the HP-41C with total software support including an Owner's Manual and thousands of programs in the HP-41C Applications Pacs, Solutions Books, and the HP Users' Library.

Experience this remarkable instrument. The new HP-41C from Hewlett-Packard. A calculator. A system. A whole new standard.

1 | Memory Modules

2 | The Printer

the computer corner White Plains Mall, 200 Hamilton Ave. White Plains, N.Y. 10601 (914)WHY-DATA.

CIRCLE 127

for Radio Shack computers

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HORIZON-2-32K-D kit	2399	1905
Assembled & tested	2765	2195
HORIZON-2-32K kit QUAD	2799	2225
Assembled & tested	3215	2555
PASCAL for NORTH STAR on Disk		49
Powerful NORTH STAR BASIC		FREE
TEI PT 212 COMPUTER 5 mHz	8000	6250
THINKER TOYS		
DISCUS/2D A&T	1149	949
DISCUS/2+2 1.2 megabytes A&T	1549	1299
MEASUREMENT SYSTEM		
MEMORY A&T 4mHz 64K		640
INTERTUBE II		
SMART TERMINAL	995	745
MARYELLEN WORD PROCESSOR Your Best Buy		38
MICROTEK PRINTER	750	675
ANADEX PRINTER	995	875
FLORIDA DATA PRINTER 600 cps	4300	3440
PDS for NORTH STAR Better than CP/M		95
COMPILER for HORIZON Secret Superfast Code		95
VERBATIM the best DISKETTES Box of 10		29
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CIRCLE 112 ON READER SERVICE CARD

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There an **APPLE**
Everywhere an **APPLE!**
APPLE!

AND GET A LOAD OF THIS DEAL!
WITH EVERY PURCHASE OF AN
APPLE II-16K
at **$1195.00**
We will sell you an **ADDITIONAL 32K *of Memory** for the incredible low price of **$99.95**

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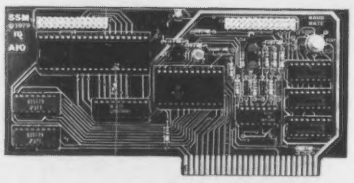
CALL TODAY (201) 835-7080
*PRIME TESTED MEMORY CHIPS

CIRCLE 126 ON READER SERVICE CARD



APPLE SERIAL AND PARALLEL INTERFACE

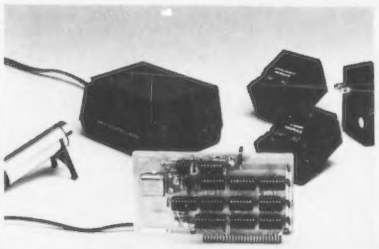
Solid State Music introduces the AIO Serial and Parallel Apple Interface. The AIO allows flexibility for interfacing an Apple II with peripherals such as printers, plotters, terminals, modems and other computers.

The AIO's parallel interface features software programmable I/O ports with enough lines to handle two printers simultaneously with handshaking control. The manual includes a software listing for controlling parallel printers, and a parallel driver routine is available in firmware as an option.

The AIO comes complete with serial interface firmware, two cable assembles and a comprehensive user's manual.

SSM, 2116 Walsh Ave., Santa Clara, CA 95050. (408) 246-2707.

CIRCLE 262 ON READER SERVICE CARD



REMOTE CONTROL FOR APPLE

Introl/X-10 allows users to remotely control 110 volt A.C. devices by commands sent over existing building wiring. Utilizing the intelligence of the Apple computer, command signals are sent to a BSR/System X-10 Command Console. The console then sends signals over existing wiring to control electrical devices.

Introl/X-10 comes with software to control devices on predetermined schedules. It provides: control of devices at a given time; selection of daily or weekly schedules; specification of day of the week or exact date for a particular event; specification of intervals of time for an event; device wattage ratings for power consumption accounting for energy management. $279.

Mountain Hardware, Inc., 300 Harvey West Blvd., Santa Cruz, CA 95060.

CIRCLE 263 ON READER SERVICE CARD

TABLET ACCEPTS HAND PRINTED CHARACTERS

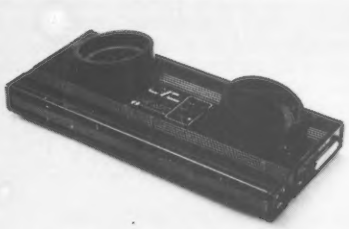
Innovision has announced its first entry in a new line of low cost peripheral devices for personal computers: the PrestoDigitizer tablet for the PET. Through the use of this tablet, personal computer users can communicate with their machines by using ordinary hand printed characters.

The user first takes part in an adaptive process in which the computer is "taught" to recognize the user's style of hand printed characters. The burden for learning is placed on the computer and not on the user.

The tablet can be used to recognize the entire upper case alphabet, numerals, and many punctuation marks. $48.50.

Innovision, P.O. Box 1317, Los Altos, CA 94022.

CIRCLE 264 ON READER SERVICE CARD



MODEM FOR PERSONAL AND SMALL COMPUTERS

An acoustic modem designed specifically for the personal and small computer market has been introduced by Novation, Inc.

Called the CAT, it is engineered to transmit data over all telephone lines, is Bell 103 compatible and has an AC wall-mount transfer.

The CAT is designed to allow businessmen and hobbyists to maximize the potential of their computers and terminals by letting one unit talk to another. $199.

Novation, 18664 Oxnard St., Tarzana, CA 91356.

CIRCLE 265 ON READER SERVICE CARD

APPLETIME FROM WEST SIDE ELECTRONICS

Model APT-1 is a Real Time Clock for the Apple II computer. Six digit time information can be displayed on the screen and printouts are used for timing events, controlling other peripherals, data logging, etc. Included is an external wall transformer which keeps the clock running when the computer is turned off. Other features include: 12/24 Hour, AC/Crystal timebase, and BCD or ASCII data format. The Appletime plugs into any slot of the Apple II and can be used with machine language or Basic programs. $79.95.

West Side Electronics, P.O. Box 636, Chatsworth, CA 91311.

CIRCLE 266 ON READER SERVICE CARD

DIRECT CONNECT MODEM

Anderson Jacobson, Inc. announces an FCC approved direct connect modem, the AJ 245 which is easily connected to a modular jack or DAA. Line connections are switch selectable and do not require internal modifications.

Anderson Jacobson, Inc., 521 Charcot Ave., San Jose, CA 95131. (408) 263-8520.

CIRCLE 267 ON READER SERVICE CARD

2KB CHIP FOR PET PROGRAMMING

The Basic Programmer's Toolkit consists of ten commands for programming on the PET in the form of a two-kilobyte ROM chip. An extensive manual that describes the installation procedure and the use of the commands, complete with examples is included.

The Toolkit is mounted on a specially constructed printed circuit board with edge connectors and attaches to the memory expansion port of any 8K PET. $79.95. It is also available as a chip that plugs into a spare socket inside the new 16K or 32K PET. $49.95.

Palo Alto ICs, 430 Sherman Ave., Palo Alto, CA 94306.

CIRCLE 268 ON READER SERVICE CARD

YOU THINK YOU'VE SEEN WORD PROCESSING SOFTWARE?

The MAGIC WAND™ Word Processing System offers you the best features of any system in the micro market

FEATURES INCLUDE:

Full-screen text editor
Simple, control key operation
Edit programs as well as text
Assemble, compile or run programs without modification
Files larger than memory
Files up to 256K
Library files
Merge part or all of one file with another
Spool printing
Print a file while editing another
Easy page formatting
Simple commands set margins, page length, etc.
Override commands at run-time
Give any command from the key board as well as in file
Variable pitch control
Change pitch in mid-line, even mid-word
Up to 128 user-defined variables
String, numeric or dollar format
Form letter generation from external data files
Compatible with both sequential and fixed-record files
Conditional commands
Any command may be conditional
Print to disk and/or printer
Save all or part of output on disk
Switch from specialty printer to CP/M list device
Print the same file on either specialty or standard printer

EASE OF OPERATION

With all its power, the MAGIC WAND is remarkably easy to use. This is no accident. The command structure is designed to be flexible and logical so that you can perform basic functions with a minimum of commands.

We have included in the manual a step-by-step instructional program, for the person who has never used a word-processor before. The trainee uses sample files from the system disk and compares his work to simulated screens and printouts.

In addition to the lessons, the manual has a complete documentation of the command structure, special notes for programmers, an introduction to CP/M for non-programmers and a glossary. The manual is typeset, rather than typewritten, for greater legibility.

We have written the manual in non-technical English, because we want you to read it. We don't overload you with a bunch of jargon that could confuse even a PhD in Computer Sciences.

We send out newsletters so that users of the MAGIC WAND can learn special applications of the print commands. For example, we might show you how to create a mailing list or set up an index for a file.

In short, we've done everything we can to make things easy for you. Because the best software in the world is just a bunch of code if you can't use it.

For more information, call or write:

small business applications, inc.

3220 Louisiana • Suite 205 • Houston, Texas 77006 • 713-528-5158

CP/M is a registered trademark of Digital Research Corp.

CIRCLE 193 ON READER SERVICE CARD

TRS-80 TAPE DIGITIZER

A tape digitizer from Alphanetics promises to eliminate bad tape loadings, permit copying of data and program tapes without using the TRS-80 computer, and simplify the process of using a cassette recorder to store and retrieve computer data. It is fully compatible with Level I and Level II tape formats, and tapes reproduced by use of this device can be played back on an ordinary cassette-TRS-80 combination.

Two features of the tape digitizer are its ability to make copies of tapes that are better than the originals, and to make copies of "system" tapes.

Alphanetics, P.O. Box 597, Forestville, CA 95436. (707) 887-7237.

CIRCLE 269 ON READER SERVICE CARD

APPLE MUSIC SYSTEM

Micro Music Inc. announces Micro Composer, an Apple II compatible low-cost music system. A step-by-step instruction manual leads the user through entering, displaying, editing and playing music with up to four voices with a four octave range.

Micro Composer allows the user to see all four voices at the same time the music is played; enter music by a coding system which keeps track of rhythmic durations; program pitch, rhythm and timbre; choose from seven different tone colors for each voice, or create his own tone color; save his music on disk or cassette. $220.

Micro Music Inc., University Plaza, Suite 8, 309 West Beaufort, Normal, IL 61761. (309) 452-6991.

CIRCLE 270 ON READER SERVICE CARD

INTELLIGENT GRAPHICS TABLET FOR APPLE

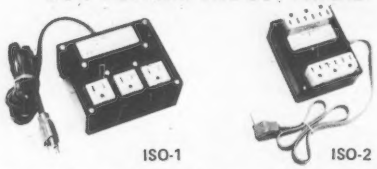
Apple Computer, Inc., announces The Graphics Tablet which gives educators, businesspeople, artists, and scientists the power of graphics for tasks ranging from digitizing circuit board schematics to creating high-resolution, multicolored original art.

The Graphics Tablet features an 11x11 inch drawing surface, a coated mylar overlay (containing the menu of tablet functions), a stylus, disk-based software, and a printed circuit interface card which plugs into the Apple computer. $795.

Apple Computer, Inc., 10260 Bandley Dr., Cupertino, CA 95051. (408) 996-1010.

CIRCLE 271 ON READER SERVICE CARD

DISK DRIVE WOES? PRINTER INTERACTION?
MEMORY LOSS? ERRATIC OPERATION?
DON'T BLAME THE SOFTWARE!



ISO-1 ISO-2

Power Line Spikes, Surges & Hash could be the culprit!
Floppies, printers, memory & processor often interact!
Our unique ISOLATORS eliminate equipment interaction
AND curb damaging Power Line Spikes, Surges and Hash.

*ISOLATOR (ISO-1A) 3 filter isolated 3-prong sockets; integral Surge/Spike Suppression; 1875 W Maximum load, 1 KW load any socket $54.95
*ISOLATOR (ISO-2) 2 filter isolated 3-prong socket banks; (6 sockets total); integral Spike/Surge Suppression; 1875 W Max load, 1 KW either bank $54.95
*SUPER ISOLATOR (ISO-3), similar to ISO-1A except double filtering & Suppression $79.95
*ISOLATOR (ISO-4), similar to ISO-1A except unit has 6 individually filtered sockets $93.95
*ISOLATOR (ISO-5), similar to ISO-2 except unit has 3 socket banks, 9 sockets total . . . $76.95
*CIRCUIT BREAKER, any model (add-CB) Add $ 6.00
*CKT BRKR/SWITCH/PILOT any model (-CBS) . . . . . Add $11.00

PHONE ORDERS 1-617-655-1532

ESP Electronic Specialists, Inc.
171 South Main Street, Natick, Mass. 01760
Dept. CC

CIRCLE 150 ON READER SERVICE CARD

What you 'C' is what you get!

C Compiler for CP/M*

New, and available now! An easily affordable compiler incorporating most of the features of the full C language.

BD SOFTWARE

System requirements: CP/M and at least 24K of RAM
Variable Types: char, int, unsigned
Composite Types: arrays, structures, unions
Pointers: to variables, structures, unions and functions
Features: is a structured language, all functions (Programs) recursive; more powerful expression operators than any other von Neuman type language; allows free-formatted source; close enough to UNIX** C to make conversions feasible.
Speed: On 2 MHz 8080, the statement for (i = 1; i < 30000; i ++) x = 5; takes about 4 seconds to execute.
Package contains: compiler, linker, library manager; standard function library; sample source files include games, a terminal emulator with disk I/Om plus the source for many standard library functions; BDS C User's Guide; Book—*The C Programming Language* by Dennis Ritchie and Brian Kernighan of Bell Labs.
Price: $110
Recipient of the Computer Lib Seal of Approval

*CP/M is a trademark of Digital Research Corp.
**UNIX is a trademark of Bell Laboratories

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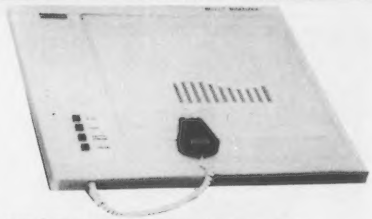


GRAPHICS POTENTIAL OF MICROCOMPUTERS ENHANCED

A demonstration disk which integrates the Hi-Pad Digitizer from Houston Instruments with any North Star-based computer and Vector Graphic's High Resolution Video Display, is available from MicroAge Wholesale.

The Hi-Pad Digitzer allows graphics input on a microcomputer with both serial and parallel interfaces as standard features. In addition to resolution by inch, metric measurement is also included on the Hi-Pad. It also has a translucent tablet area for rear projection. $795.

MicroAge Wholesale, 1425 West 12th Pl., Tempe, AZ 85281. (602) 894-9247.

CIRCLE 272 ON READER SERVICE CARD

PENRIL 300/1200 MODEM

U.S. Robotics, Inc. introduces the new 300/1200 modem which operates at 300 or 1200 baud, half or full duplex

over voice grade telephone lines. The modem incorporates a 300 and a 1200 baud modem into one package. The 300/1200 modem can be incorporated into existing low speed systems. When the system is upgraded, the unit can take immediate advantage of the higher data rate. $799.

U.S. Robotics, Inc., 1035 W. Lake St., Chicago, IL 60607.

CIRCLE 273 ON READER SERVICE CARD

WORD PROCESSING

THREE NEW SYSTEMS

The System-Z Word Processor and Business System features the Z-80 processor, S-100 bus, CP/M Disk Operating System, a full-sized disk drive (standard), 32K RAM, basic printer I/O, a fully encoded ASCII keyboard, CRT video monitor, and software. $2,899.

The System 8 features the MicroDaSys custom console, keyboard, S-100 bus motherboard, 16 amp power supply, fan, 80x24 video/graphics card, and the MD-690b 6809 based CPU board. The system includes a 2400 baud cassette interface, 10K PROM space, 1K RAM, 20 I/O lines, an RS-232 interface, and interrupt driven keyboard input. The MicroDaSys ColorMaster video card allows the addition of 8-color video generation as a system option. $798.

The System 9 includes those features found in the System 8 and adds a 32K static RAM card populated with 8K of RAM chips.

MicroDaSys, P.O. Box 36051, Los Angeles, CA 90036. (213) 935-4555.

CIRCLE 274 ON READER SERVICE CARD

"DOCUMENT PROCESSOR"

Computer Data Systems, Inc. has announced the Versatile "Document Processor," a complete turnkey system with a Versatile 4 Dual Drive computer and a Qume Sprint 5 letter quality printer. $10,000.

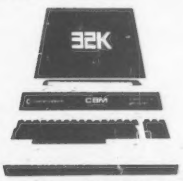
CDS, Building #3, Drummond Plaza, Newark, DE 19711. (302) 738-0933.

CIRCLE 275 ON READER SERVICE CARD

NEECO

PROUDLY ANNOUNCES THE NEWEST HARDWARE AND SOFTWARE FOR YOUR PET!

The PET is now a truly sophisticated Business System with the announcement of these peripherals and software packages.



PRODUCT	DESCRIPTION	PRICE	AVAILABILITY
PET 2001—8KN (Large Keys)	8K RAM	$ 795	DEC/JAN
PET 2001—8K	8K RAM	$ 795	IMMEDIATE
PET 2001—16KN (Large Keys)	16K RAM*	$ 995	IMMEDIATE
PET 2001—32KN (Large Keys)	32K RAM	$1295	IMMEDIATE
PET 2023 PRINTER	ROLL FEED	$ 850	IMMEDIATE
PET 2022 PRINTER	TRACTOR/ROLL	$ 995	IMMEDIATE
ROMRETRO KIT	UPDATED O/S	$ 90	IMMEDIATE
PET 2040	DUAL FLOPPY*	$1295	IMMEDIATE
PET C2N	2nd Cassette	$ 100	IMMEDIATE

*The 16K/32K (large keyboard) units do not include a cassette drive. Order C2N Cassette. 2040 Floppy Drive requires a 16K or 32K unit. 8K RAM Retrofit available July.

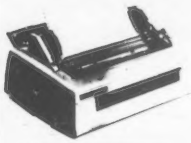
ALL PETS ARE FULLY TESTED BY NEECO BEFORE SHIPMENT. NEECO IS A FULL CUSTOMER-ORIENTED BUSINESS. CALL FOR OUR FREE CATALOG. SEND US A COPY OF THIS AD WITH AN ORDER AND WE WILL WARRANTEE YOUR COMMODORE PET FOR ONE FULL YEAR!

PET-DISK BASED BUSINESS SOFTWARE

SOFTWARE/APPLICATION	REQUIRES	AUTHOR	AVAILABILITY	PRICE
WORDPRO II / WORD PROCESSING	2040 + 16K PET	PRO/MICRO	IMMEDIATE	$100
WORDPRO III / WORD PROCESSING	2040 + 32K PET	PRO/MICRO	DECEMBER	$200
GENERAL LEDGER	2040 + 32K PET	CMS SOFTWARE	IMMEDIATE	$295*
ACCOUNTS PAYABLE	2040 + 32K PET	CMS SOFTWARE	DECEMBER	$295*
ACCOUNTS RECEIVABLE	2040 + 32K PET	CMS SOFTWARE	DECEMBER	$295*
MAILING LIST	2040 + 32K PET	CMS SOFTWARE	IMMEDIATE	$100
NEECOLEDGER	COMPUTHINK .4 M DRIVE + 32K PET	NEECO	IMMEDIATE	$795
NEECOMAILER	COMPUTHINK .4 M DRIVE + 32K PET	NEECO	IMMEDIATE	$150

*The CMS Software (G/L, A/R, A/P) are based on Osborne & Associates trial tested business basic software. Software is complete with full documentation and user instructions. All packages require a printer for output. Commodore recommends the NEC Spinwriter (available from NEECO) as the output printer for WORDPRO.

DEALER INQUIRIES INVITED ON SOFTWARE & NEC (PET) SPINWRITER



FOR WORD PROCESSING NEC IS BEST!

* 55 characters per second output speed
* Changeable thimble for different typestyles
* Less than 1% warranty malfunction rate
* IBM quality letter output
* Dealer inquiries invited

THE NEC SPINWRITER MODEL 5530-P (Centronics I/O modified for PET)

$2995

*Price includes IEEE interface to PET. IEEE Port is available for use with 2040 Dual Disk.

*The NEC 5530-P is the output printer recommended by Commodore for their Word Processing System.

NEECO

NEW ENGLAND ELECTRONICS CO., INC.
679 HIGHLAND AVE., NEEDHAM, MASS. 02194
SHOWROOM HRS.: MON - FRI. 9:30 - 5:30, EST.

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TELEX NUMBER 951021, NEECO

CIRCLE 173 ON READER SERVICE CARD

CHESS * BACKGAMMON * MORE!

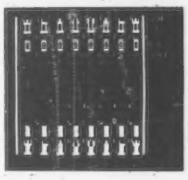
TRS-80

NEW MACHINE LANGUAGE GAMES!

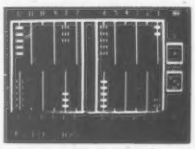
FOR 16K LEVEL II

Z-CHESS

PLAY THE CLASSIC GAME OF CHESS USING THE TRS-80 GRAPHICS. SEVEN LEVELS OF DIFFICULTY (UP TO SIX LEVELS OF "LOOK AHEAD") PROVIDE A CHALLENGING GAME FOR ALL. ALPHA-BETA PRUNING AND MOVE SORTING ARE EMPLOYED TO KEEP RESPONSE TIMES TO A MINIMUM. SETUP MODE ALLOWS THE BOARD TO BE ARRANGED AS DESIRED. PLAYS ALL MOVES — INCLUDING CASTLING AND EN PASSANT CAPTURES. NUMBERED SQUARES SIMPLIFY MOVE INPUT. POSSIBLY THE FASTEST GOOD STRATEGY CHESS GAME AVAILABLE! ..... $ 17.95



BACK-40



A SUPERIOR OPPONENT WHICH MAKES EXTENSIVE USE OF THE TRS-80 GRAPHICS TO DISPLAY A REGULATION STYLE BACKGAMMON BOARD OF UNRIVALED QUALITY AND CLARITY — INCLUDING THE DICE! BACK-40 DOUBLES IF IT STANDS A GOOD CHANCE OF WINNING — WHICH IT USUALLY DOES! EVERY FEATURE OF A REGULATION BACKGAMMON MATCH IS INCLUDED — EVEN KEEPS SCORE! $14.95

DR. CHIPS

A FASCINATING PROGRAM BASED ON THE FAMOUS "DOCTOR" AND "ELIZA" PROGRAMS. SIMPLY "TALK"(ER, "TYPE") TO YOUR COMPUTER — DR. CHIPS WILL ANALYZE YOUR SENTENCES AND "TALK" BACK TO YOU — IMMEDIATELY! ALTHOUGH DR. CHIPS' RESPONSES SHOULD NOT BE TAKEN SERIOUSLY HE IS THE ULTIMATE COMPUTER INTRODUCTION FOR THE FAMILY AND FRIENDS — AND A SUPER "CONVERSATIONALIST" AT PARTIES! $14.95

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CIRCLE 196 ON READER SERVICE CARD

TERMINALS & I/O

Z-8 BASED CRT

Called the miniMas, Micro Application Systems' Z8-based CRT is designed for large-volume applications where durability and compact size are essential.

Standard hardware features include: 12" CRT, 7x9 dot matrix displaying all 128 ASCII characters, 24x40 or 80 characters, 25th line status display, 4 K memory for 2-page display, inverse screen, sixteen baud rates for each of I/O and auxiliary ports.

Standard software features include: page mode, scroll mode, transmit (page mode), XY placement of cursor, new line mode, keyboard lock/unlock, erase from cursor to end of line or screen, protected field mode in conjunction with any combination of attributes, tab to next field, and function code compatability with VT52, ADM3A, Hazeltine 1400-1500, and ADDS Regent 100-200.

Micro Application Systems, 5575 North County Rd. 18, Minneapolis, MN 55442. (612) 559-0320.

CIRCLE 276 ON READER SERVICE CARD

BIDIRECTIONAL RS-232 PORT FOR PET

TNW Corporation offers the TNW-2000 Serial Interface to a bidirectional RS-232 port to the Commodore PET and other IEEE-488 computers. Users of these computers can now interface them to standard RS-232 printers, terminals, and modems, and to other computers.

The TNW-2000 is delivered as a fully assembled and tested unit with cabinet, IEEE bus cable, built-in female EIA (RS-232) connector, and full documentation. $229.

TNW Corporation, 3351 Hancock St., San Diego, CA 92110. (714) 225-1040.

CIRCLE 277 ON READER SERVICE CARD

PRINTER FOR MINIS AND MICROS

DIP, Inc. announces the model DIP-80 Data Impact Printer.

The model DIP-80 features 7x7 or 14x7 matrix printing, upper/lower case character set, 100 characters per second bidirectional print-out, roll or fan-fold paper, "finger clean" ribbon cartridge loading, and a low 3.5" profile.

DIP-80 is designed to interface directly with mini and micro computers.

DIP, Inc., 210 Lincoln St., Boston, MA 02111. (617) 482-4212.

CIRCLE 278 ON READER SERVICE CARD

TARBELL VDS-II
Vertical Disk Subsystem

SYSTEM INCLUDES:
- 2 Siemens 8" Disk Drives
- 1 Cabinet with Fan and Power Supply.
- 1 Tarbell Floppy Disk Interface, assembled & tested.
- 1 CP/M* Disk Operating System.
- 1 Tarbell BASIC.
- All Cables and Connectors.
- Complete User Documentation.
- Fully Factory Assembled and Tested.

VDS-II Single Density $1888
VDS-IID Double Density. $1999

CP/M is a product of Digital Research Corp.

Tarbell Electronics
950 DOVLEN PLACE, SUITE B
CARSON, CA 90746
(213) 538-4251 • (213) 538-2254

CIRCLE 207 ON READER SERVICE CARD

3G LIGHT PEN PET TRS-80 LEVEL II

TRS-80
- Economy — $19.95 (Plugs into tape recorder. Batteries and sample program included.)
- Professional — $34.95 (Plugs into expansion port. Allows other expansion port use. No batteries needed. Includes Demo-Game Cassette.)

PET
- Professional — $29.95 (Plugs into user port. No batteries needed. Sample program included.)

No assembly necessary — ready to plug in. Demonstration program and complete documentation so you can write your own programs in BASIC.

—MAIL COUPON TODAY—

3G Company, Inc. Dept. CC (503) 662-4492
Rt. 3, Box 28A, Gaston, OR 97119

☐ TRS-80 Economy $19.95 ☐ TRS-80 Professional $34.95 ☐ PET Professional $29.95

Rush me _____ 3G LIGHT PENS.
(Add $1.50 for mailing and handling — $6.00 foreign.)
Enclosed is ☐ Check or Money Order ☐ Master Charge ☐ Visa

Card No. Exp. date

NAME _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

REMEMBER, 3G OFFERS A 30 DAY UNCONDITIONAL MONEY BACK GUARANTEE!

CIRCLE 208 ON READER SERVICE CARD

TYPEWRITER/PRINTER FROM MICROCOMPUTER DEVICES

Microcomputer Devices introduces a low-cost, letter-quality terminal/printer with IBM Selectric II typewriter capability and designed for the TRS-80, Apple, Sol and other personal computers.

Called the Selectra-Print, the combination output terminal/printer is a computer version of the IBM Selectric II incorporating customized actuator solenoids for print commands. It also retains typewriter capability. Standard features include 31 changeable type fonts and sizes, 15 CPS speed, full upper and lower case alphanumeric display, tab commands, and backspace and index keys. Options available include dual 10 or 12 pitch, correction key, tractor and pin feed, noise reduction and RS-232 interface. $1,925 for TRS-80 interface; $1,850 for other computers.

Micro Computer Devices, 3156 East LaPalma Ave., Department H., Anaheim, CA 92806. (714) 630-8206.

CIRCLE 279 ON READER SERVICE CARD

INTERFACE TRS-80 TO IBM MODEL 50

Mediamix introduces a line of products related to interfacing the TRS-80 to the new IBM Model 50 Electronic Typewriter. These products include a hardware interface for connecting the Model 50 to the CPU or the expansion interface. Software includes a printer driver program, patches for the Electric Pencil, as well as other special application programs (including a program for typing TV/movie scripts).

The IBM Model 50 when combined with the Mediamix products can type in 10 and 12 pitch regular type, or proportionally spaced type with right justification capability. Sentence and word underlining, title centering, indented paragraphs and an array of special codes are available.

Mediamix, Box 8775, Universal City, CA 91608.

CIRCLE 280 ON READER SERVICE CARD

PRINTER FOR TRS-80

Matchless Systems has added an 80-column, bi-directional, 5x7 dot matrix printer to its line of TRS-80 related products.

A full 96 ASCII set permits printing upper and lower case characters which can be expanded for double-width fonts in bold face.

The printer has a Centronics-compatible parallel interface and may also be used directly with Apple, Sorcerer, or any standard computer with parallel interface. $749.

Matchless Systems, Dept. 3, 18444 South Broadway, Gardena, CA 90248. (213) 327-1010.

CIRCLE 281 ON READER SERVICE CARD

BUSS

THE INDEPENDENT NEWSLETTER OF HEATH CO. COMPUTERS

Published since April 1977

►News of compatible hardware and software

►Candid accounts of experiences of users

►Hardware modifications

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►Start with the latest issue or available back issues (about 10)

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Buss, 325-I Pennsylvania Avenue, S.E. Washington, DC 20003

CIRCLE 120 ON READER SERVICE CARD

HOW TO MAKE MONEY WITH YOUR PERSONAL COMPUTER

NEW 224-page research report, HOW TO MAKE MONEY WITH COMPUTERS—by Jerry Felsen, Ph.D. —shows you more than 30 high-profit computer business and investment opportunities:

- How to use personal computers for stock market and option trading
- 27 start-at-home computer businesses including consulting, contract programming, software packages, free-lance writing, systems houses, seminars, newsletters . . . and 20 more
- How to invest in securities of the Computer & Information Industry for above-average returns
- How to predict future direction of stock market trends with 80% accuracy . . . advanced investment decision models for market timing and stock selection based on *artificial intelligence* techniques
- How to double your money in less than one year by trading in listed options
- Plus—computer technological forecasting, marketing . . . and much, much more

EXAMINE FREE FOR 10 DAYS, write for this information-packed handbook today. Shipped postpaid with a 10-day money-back guarantee. Enclose this ad and your check for $15.95, together with your name & address, and mail to **MAN-COMPUTER SYSTEMS, INC.**; Suite K-10; 84-13 168th St.; Jamaica, N.Y. 11432. (New York residents please add sales tax.)

LOWECO DECEMBER DISCOUNTS ON TRS-80 PROGRAMS

(1) **TELEPHONE/ADDRESS/MAILING** — Name & Zip Sort. Even retrieves name from phone #. Very quick access of over 140 listings per 16K RAM.

(2) **CHECKBOOK** — Keep up with, or ahead of, the bank. With 45 account categories, vendor names, & easy access. Holds about 170 checks per 16K RAM.

(3) **TAX AUDIT** — Offers 40 dedicated tax deduction column expenses with room for 5 more of your own. Keeps track of vendors and saves pencils. 200 listings per 16K RAM.

(4) **MANDALAS FOR THE CYBERNETIC AGE** — Warning: Highly hypnotic graphics. 2 sets of 4 interweaving designs. $15.

All Level II 16K Cassettes, for December, $20. or as noted.

LOWECO also carries Microsoft, TSE and TBS for the Tandy Trademark TRS-80. Our 12/31/79 **"Welcome To The 80's"** mailing will be full of TRS Tips, Peeks and Pokes. If you circle Reader Service Number 160 or are already on our list, then you'll receive it, else you won't.

Loweco Computor
1803 Rodney
Los Angeles, CA 90027
213-660-7530

Money order, cashier's check speeds delivery
6% sales tax for Californians

CIRCLE 160 ON READER SERVICE CARD

Channel Data Systems

Commodore PET™ | TRS-80 Level II

The Channel Data Book for Pet $20
A complete hardware and software updated reference service listing descriptions for over 1400 software programs and over 200 peripheral devices for PET. Designed to organize documentation, newsletters, listings, and other user selected information in an attractive 3-ring binder.

Omnifile $20
A powerful database program with sorting, formating, and computational features for accessing and processing almost any type of record. Suitable for mailing lists, checkbook and other transaction records, inventories, sales records, statistical records and even as a cash register.

General Ledger for PET only $20
GENERAL LEDGER is an enhanced version of the PERSONAL LEDGER program that is configured to operate with the new Commodore PET or CBM computer systems. Transactions and account data can be stored on the Commodore 2040 Dual Disk or cassette. GENERAL LEDGER occupies about 6.2K of RAM memory so a 16K machine will allow about 200 accounts with names and budgets specified by the user. An audit trail of all entered transactions is printed on the printer or screen and stored on tape or disk. A companion program, OMNIFILE, allows analysis of the transactions stored on tape or disk.

Explore for PET only $15
Explore Washington, D.C., operate a computerized tank, hunt treasure in a magic cave or survive in a haunted castle. EXPLORE brings you four stories in which you participate. A self tutor course is also provided to get you started. Inspired by the computerized fantasy simulation "Adventure", EXPLORE is a conversational program which operates on the Commodore PET with only 8K bytes of memory. EXPLORE is provided on cassette with an introdution, the Explore program and five data files. It also includes a manual with program notes and modifications for use with the new ROM set.

Cash, Checks, Money Orders, Visa, Master Charge

805 964-6695

5960 Mandarin Ave. Goleta CA 93017

CIRCLE 122 ON READER SERVICE CARD

SOFTWARE

SYSTEMS SOFTWARE

LANGUAGES

Cromemco **32K Structured Basic,** designed to run in 64K Cromemco Systems, is said to assist the programmer in building a program from logical blocks of code. It is available on either 8″ or 5″ disk. $295.

Cromemco, Inc., 280 Bernardo Ave., Mountain View, CA 94043, (415) 964-7400.

CIRCLE 283 ON READER SERVICE CARD

SYSTEMS

Percom Data Company announces a **6809 operating system** for the company's SS-50 bus compatible 6809 control computer and other 6809 MPU systems. Called Psymon, the 1K operating system includes eight monitor-type commands and 15 callable utilities.

Percom Data Company, 211 N. Kirby, Garland, TX 75042, (800) 527-1592.

CIRCLE 284 ON READER SERVICE CARD

Chaos II, a high level, time-shared operating system of the 8080 and Z80 series of microcomputers, utilizes Bell Laboratories' UNIX system as its model. The system features multiprogramming; several programming languages; complete file/directory system with file protection/sharing; command lines and files with user-defined arguments, wildcard file names and macro argument passing capability; program nesting/recursion and inter-language calls. $300.

Computer Systems Design Group, 3632 Governor Dr., San Diego, CA 92122.

CIRCLE 285 ON READER SERVICE CARD

PCNET announces the availability of computer **mail support software for the PET** called PAN, which enables the user to exchange written messages with another computer. The package, which is designed for use with an 8K or larger PET, includes a perpetual license for the software and a user's manual. $12.

People's Computer Company, P.O. Box E, Menlo Park, CA 94025.

CIRCLE 286 ON READER SERVICE CARD

RECREATION, GAMES

Microsketch II, written for TRS-80 Level II or 32K Disk BASIC systems, allows the user to draw and create patterns on the COMPUTER SCREEN. It contains five subsystems: Automatic Pattern Designer, Typewriter, Big Print, Graphic String Creation and Command String Creation. Screens created using Microsketch II may be further manipulated using **Microscreen,** which has the capability of storing up to ten screens in memory simultaneously. $3.95.

International Data Services, 340 W. 55th St., New York, NY 10019. (212) 765-8610.

CIRCLE 287 ON READER SERVICE CARD

Artist and Easel for the Imagination Machine allows the computer user to "draw, doodle and play." Artistic creations may be stored on cassette tape. The **Music Box/ Player Piano** cassette allows the user to compose music with the Imagination Machine.

APF Electronics, Inc., 444 Madison Avenue, New York, NY 10022, (212) 758-7550.

CIRCLE 288 ON READER SERVICE CARD

Using **Keynote** from Hayden Book Company, the TRS-80 user may input music through the keyboard or from a pre-recorded cassette, review and edit the piece, and play it through the tape player or external amplifier. $9.95. **Sargon II,** which came in third at the 9th North American Computer Chess Championship, is available for TRS-80 Level II and Apple II. It includes seven levels of play and a special hint mode. $29.95.

Hayden Book Company, Inc., 50 Essex Street, Rochelle Park, NJ 07662, (201) 843-0550.

CIRCLE 289 ON READER SERVICE CARD

****** TRS 80 DISK BASED BUSINESS SOFTWARE ******

ALL PACKAGES UTILIZE RANDOM ACCESS. EXTENSIVE ERROR TRAPPING, EFFICIENT CODE, FOLLOW-UP ASSISTANCE, USER DESIGNED SCREENS, AND MUCH MORE. WE'RE NOT "CHEAP" BUT WE'RE DE-BUGGED.

INVENTORY	REPORTING INCLUDES SLS, REORDER, 01h, VEN, COST, REC. RANDOM ACCESS BY ITEM # OR BY STOCK #. 100 VENDORS 1400 ITEMS.
GENERAL LEDGER	200 ACCTS + CONTRA (USER DEFINED). TRAIL BAL, P&L, BAL SHEET, JOURNAL LISTING, CHART OF ACCTS. DOESN'T ACCEPT O/B JOURNALS.
PAYROLL	SAL/HRLY INS DED + 2 MISC. FULL REPORTING FICA, STATE, FED, F.U.T.A. 80 + EMPLOYEES.
ACCTS REC	BAL FWD, AGING AND BILLING RPTS. RECORDED BY INV # OR CHECK #. 300 ACCTS.
MAIL/LIST	SORT BY ZIP, NAME, USER CODES. FULL OR PARTIAL PRINTING. 4 LINES N/A. SUPPORTS 900.
GAMES PACK	6 GAMES INCLUDING 80-OUT (BREAKOUT). DISK OR TAPE. TAPE (16K LEVEL 2) DISK (32K RAM)

WHOOPS I'M RUNNING OUT OF ROOM
PRICES: INVEN, G.L., PAYROLL, A/R $265.00
MAIL/LIST 79.95 GAMES PACK $ 39.95
ALSO AVAILABLE JOB COSTING* PAYABLES, AND CUSTOM APPLICATIONS AND FREE UP TO DATE INFORMATION ABOUT NEW AND FUTURE TRS-80 PRODUCTS.

AFFORDABLE BUSINESS SYSTEMS INC.
2101 E. BROADWAY RD., SUITE NO. 11
TEMPE, AZ 85282 TEL.: 602-966-3339

SPEND A DIME AND CALL FOR MORE INFORMATION
CIRCLE 109 ON READER SERVICE CARD

TRS-80 CUSTOM SOFTWARE

Programs designed to do EXACTLY what you want.

ANY APPLICATION FULLY WARRANTEED

To perform as Designed, if any "BUGS" are found they will be EXTERMINATED - FREE of CHARGE.

PRINTOUT'S of all PROGRAMS & SAMPLE RUNS supplied.

(sorry no games)

For complete info. send Type of Basic Mem. Size, No. of Disc Drives, Type Printer, Description of Data to be used, and Format of Output Desired. OR CALL

GEORGE MEYER (201) 485-1555
8AM - 8PM

G M SOFTWARE SERVICE
85 Jay St., Newark, N.J. 07103

CIRCLE 153 ON READER SERVICE CARD

TRS-80 disk software

DATA BASE MANAGER IDM-III You can maintain a data base & produce reports without any programming. Define file parameters & report formats on-line. $49. Enhanced version $69. 32K.

ACCCOUNT manage client accounts & accounts receivable. Order entry, print invoices, statements & reports. 32K req $69.

WORD PROCESSOR Specifically designed for the TRS-80. Written in BASIC. No special hardware, no text limit. $39. 32K version $49.

INVENTORY 9-digit key for fast on-line random access. Reports give order info, performance summary, etc. $39. 32K version $49.

MAIL print reports & labels sorted by any field. Random access. special buffering technique. $35. 32K version $49 advanced version $59.

KEY RANDOM-ACCESS UTIL hashing, blocking, buffering. $19.

Send $5 for each manual.

MOD-II, superior business software available.

MICRO ARCHITECT
96 Dothan St., Arlington, MA 02174
CIRCLE 164 ON READER SERVICE CARD

FREE
SOFTWARE CATALOG

For a **free** 20-page catalog of Creative Computing Software for all computers circle 217 on the reader service card.

GameMaster is a computer-gaming-information network for personal computer users in the Midwest. It may be used by any personal computer equipped with a modem.

GameMaster, 205 W. Wacker Dr., #1517, Chicago, IL 60606.

CIRCLE 290 ON READER SERVICE CARD

EDUCATION

Real Estate is a self-study program of 21 segmented lessons which prepare the student to take the real estate agent's/broker's licensing examination. Subject areas include real estate law, finance, mathematics, appraisal techniques, public control and miscellaneous topics. The initial release version is designed to run in North Star BASIC. $299.

Media 2001, P.O. Box 614, Corte Madera, CA 94925, (415) 924-5311.

CIRCLE 291 ON READER SERVICE CARD

Math Tutor for APF's Imagination Machine is designed to teach and strengthen arithmetic skills. The program's personal performance response feature automatically adjusts the level of difficulty of the problems presented.

APF Electronics, Inc, 444 Madison Ave., New York, NY 10022, (212) 758-7550.

CIRCLE 292 ON READER SERVICE CARD

BUSINESS

A TRS-80 Level II computer will serve as a printing calculator when equipped with **Calculator Plus** from Manhattan Software. The program also works as an on-screen calculator without a printer, providing chain and mixed calculations on screen, with a print command to record intermediate steps, if desired, and the final answer. $9.95.

Manhattan Software, Inc., P.O. Box 5200, Grand Central Station, New York, NY 10017.

CIRCLE 293 ON READER SERVICE CARD

Intersystems Software Inc. announces **Tickertec-TRS** on cassette or disk for the TRS-80, a system which allows the user to watch the New York Stock Exchange or American Stock Exchange ticker tape on a real time basis and monitor 48 or more stocks. Prices start at $1000.

Max Ule & Company, 6 E. 43rd St., New York, NY 10017.

CIRCLE 294 ON READER SERVICE CARD

A Property Management System from Timberline Systems provides information for administrators and managers of retail, commercial and residential properties. A general ledger function allows users to prepare financial statements detailing such things as expenses versus revenues, vacancy rates and a property valuation analysis.

Timberline Systems, Inc., 10550 S.W. Allen Blvd., Suite 114, Beaverton, OR 97005, (800) 547-1443.

CIRCLE 295 ON READER SERVICE CARD

Creative Computer Consultants has released Volume I of its Standard Software Library, a **general ledger** program for microcomputers which includes program listings, sample runs, user and implementation documentation. All programs are written in IBM Basic for a system with 24K of memory. $15.95.

Creative Computer Consultants, Inc., P.O. Box 2111, 1 Quarry Lane, Norwalk, CT 06851, (203) 847-0141.

CIRCLE 296 ON READER SERVICE CARD

A Telephone Dialer Program for TRS-80 Level II will hold up to 500 names and telephone numbers in a 16K memory. After the program dials the desired number, the user presses "Enter" and the computer displays the length of the call continuously by the second. At the end of the call, the user can insert the rates for the call and the computer will display the total call time and charge. $10.

Blechman Enterprises, 7217 Bernardine Ave., Canoga Park, CA 91307.

CIRCLE 297 ON READER SERVICE CARD

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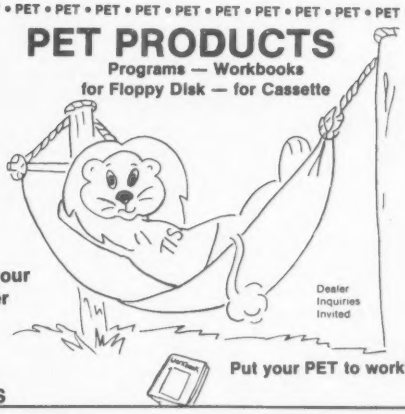
PET PRODUCTS

Programs — Workbooks for Floppy Disk — for Cassette



See your Dealer

Dealer Inquiries Invited

Put your PET to work!

TIS

PROGRAMS		WORKBOOKS	
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SW-4	**MEDIT** create and maintain data files	WB-4 **PET Cassette I/O**	$4.95
SW-5*	**CALENDAR** appointments, meetings at a glance	WB-5 **Miscellaneous PET Features**	$3.95
		WB-6 **PET Control and Logic**	$3.95

*These programs are special purpose data base management systems. They all can:

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TI810 RO Printer	1,895	181	99	66
TI820 KSR Printer	2,195	210	114	77
ADM3A CRT Terminal	875	84	46	31
QUME Letter Quality KSR	3,195	306	166	112
QUME Letter Quality RO	2,795	268	145	98
HAZELTINE 1410 CRT	895	86	47	32
HAZELTINE 1500 CRT	1,095	105	57	38
HAZELTINE 1552 CRT	1,295	124	67	45
DataProducts 2230	7,900	755	410	277
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Realty Software Company has released the **Tax Deferred Property Exchange Model** for Apple II and TRS-80 Level II. The program calculates the total financial impact of a tax deferred or partially tax deferred property exchange, allowing investors and realtors to make informed decisions when trading property. Cassette, $20; diskette, $25.

Realty Software Company, 2045 Manhattan Ave., Hermosa Beach, CA 90254, (213) 372-9419.

CIRCLE 298 ON READER SERVICE CARD

WORD PROCESSING/ TEST EDITING

The **Type-Right Word Processor** is a screen-oriented word processing system using conventional CRT terminals (e.g. Hazeltine 1500, Infoton 100, Soroc 120) in conjunction with the AM-100 system. Khalsa Computer Systems, Inc., 500 South Lake Ave., Pasadena, CA 91101. (213) 684-3311.

CIRCLE 299 ON READER SERVICE CARD

Letteright for CP/M is designed to handle typical office correspondence needs. Using this package, the operator can create a single copy or multiple copies of a letter or document and insert values which customize each. Structured Systems Group, 5204 Claremont Ave., Oakland, CA 94618.

CIRCLE 300 ON READER SERVICE CARD

Master Text Processor for Apple II or TRS-80 includes its own mailing list program and form letter element along with features such as automatic line generation, insert with forward and reverse merge operations and upper and lower case control. $120. Creative Discount Software, 256 S. Robertson, Suite 2156, Beverly Hills, CA 90211. (800) 824-7888; in California, (800) 852-7777; in Alaska and Hawaii, (800) 824-7919.

CIRCLE 301 ON READER SERVICE CARD

Designed for the Apple II and Apple Plus, the **Personal Text Processor** is a disk-based package of chained Basic programs which allow for entry, editing and printing of letters and reports. The system allows user control of video output through the use of the Apple paddles to roll over text and control draft display speed. $69.95. Charles Mann & Associates, Micro Software Division, 7594 San Remo Trail, Yucca Valley, CA 92284. (714) 365-9718.

CIRCLE 302 ON READER SERVICE CARD

The **Word Processing ROM PAC Cartridge** from Exidy transforms the Sorcerer computer into a dedicated word processing system. Either cassette recorder or mini-floppy disk may be used for data storage. $99. Exidy Data Products, 390 Java Dr., Sunnyvale, CA 94086.

CIRCLE 303 ON READER SERVICE CARD

HOME MANAGEMENT/ BUDGETING

Manhattan Software has released **Checkbook Plus** to help TRS-80 users with checkbook and bank statement reconciliation. The user enters the checkbook balance, the bank's balance, outstanding checks, and bank charges to check his balance against the bank's figures. $9.95.

Manhattan Software, Inc., P.O. Box 5200, Grand Central Station, New York, NY 10017.

CIRCLE 304 ON READER SERVICE CARD

UTILITIES AND MISCELLANEOUS

Scan is a machine language addition to North Star Basic which allows the user to display or print all occurrences of any character, group of characters, number, line number or statement. $27.50.

Electronic Technicians Software Services, 1072 Casitas Pass Rd., Carpinteria, CA 93013.

CIRCLE 305 ON READER SERVICE CARD

The **Byrom Software Telecommunications Access Method** (BSTAM) is a system which enables transmission of program or data files between any two computers on which it is installed. It is compatible with all 8080/Z80 systems using CP/M operating systems or a derivative, including Heath and TRS-80 adaptations. $150.

Lifeboat Associates, 2248 Broadway, New York, NY 10024, (212) 580-0082.

CIRCLE 306 ON READER SERVICE CARD

Unlist is a program designed t protect Basic programs written f the TRS-80 from unauthorized m ification. It runs on a single system with 32K memory. $19.95.

Data Associates, Box 882, Framingham, MA 01701.

CIRCLE 307 ON READER SERVICE CARD

The **RPTGEN** system, written in North Star Basic, is an applications package designed to render up to 18 fields of data/comments in an organized report complete with headings and sub-headings. $399.

Media 2001, P.O. Box 614, Corte Madera, CA 94925.

CIRCLE 308 ON READER SERVICE CARD

Information File Organizer is a data base manager program for the Apple II which can create, add, change, delete, print, list and format data in various report formats. Up to 20 data header names and variable data lengths can be assigned, and the data records may be sorted or searched by any header name. $100.

Software Technology for Computers, P.O. Box 428, Belmont, MA 02178.

CIRCLE 309 ON READER SERVICE CARD

Baclan, Inc. has announced the **File Helper** diskette for the Apple II, which consists of five programs which can be used as general utilities to build, copy, scan, sort and print data files. Integer Basic version, $39; Applesoft version, $49.

Baclan, P.O. Box 36, Columbia, MD 21045.

CIRCLE 310 ON READER SERVICE CARD

Slow List/Stop List allows the user to start, stop, and control the speed of a listing with the Apple II's game paddles. $19.95. **Revive** is designed to help the Apple user who has accidentally erased lines of Applesoft code. The program searches through memory and finds the information that enables it to restore the pointers and revive the program. $10.95.

Hayden Book Company, Inc., 50 Essex St., Rochelle Park, NJ 07662, (201) 843-0550.

CIRCLE 311 ON READER SERVICE CARD

The **Apple II Utility Pack** provides the following routines in one set on cassette or disk: Renumbering, Append, Address Hex Converter, Line Find, Va[illegible]Str$(), Screen Page Map and Move. $19.95. **Apple-Doc** aids in the development and documentation of Applesoft programs by providing information on variables and lines and allowing the user to change elements throughout the listing. Cassette, $9.95; Diskette, $13.95.

Southwestern Data Systems, P.O. Box [illegible], Santee, CA 92071, (714) 561-3[illegible]

CIRCLE [illegible] ON READER SERVICE CARD

FIRMWARE FOR SORCERER

Exidy Incorporated has announced the addition of the Development PAC™ to the Sorcerer computer product line. The Development PAC software allows for Z80 microprocessor assemblies, program editing and debugging.

It has a line oriented Editor that allows forward cursor positioning, line delete and insert, input and output of source code to any device driver, and spooling. The edit buffer is left intact for immediate use by the Assembler. The debugger can display and/or modify any RAM location or Z80 program register. It will execute a program with breakpoints and serve as a tool in isolating programming problems. $99.00.

Exidy Data Products, 390 Java Dr., Sunnyvale, CA 94086.

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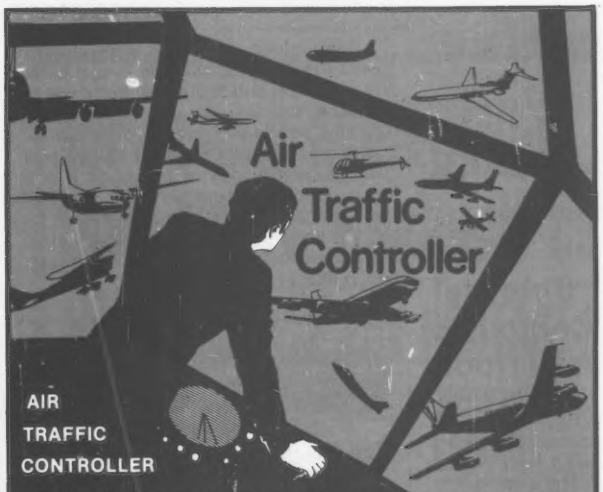

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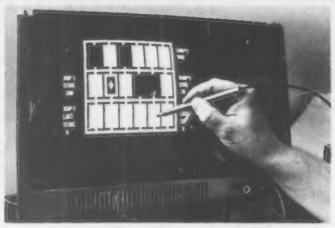

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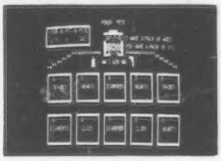

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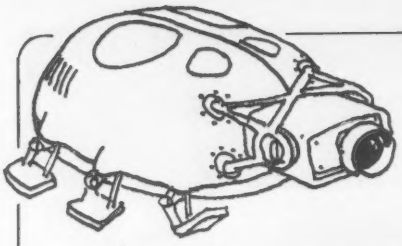

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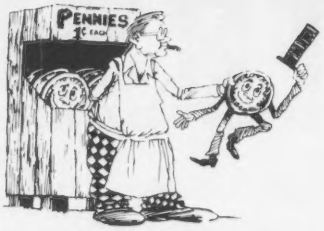

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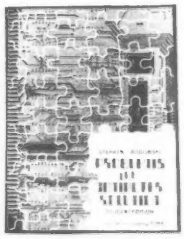

Problems for Computer Solution

Problems for Computer Solution by Stephen J. Rogowski is an excellent source of exercises in research and problem solving for students and self-learners. Problems like the Faulty Speedometer Spotter make learning fun and easy. 104 pages, softbound, [9Z] $4.95.

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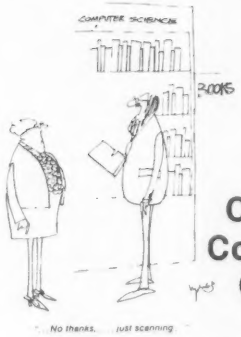
The first two years of **Creative Computing** magazine have been edited into two big blockbuster books. **American Vocational Journal** said of Volume 1, "This book is the 'Whole Earth Catalog' of computers." [6A] Volume 2 continues in the same tradition. "Non-technical in approach, its pages are filled with information, articles, games and activities. Fun layout." —**American Libraries.** [6B] Each volume $8.95.



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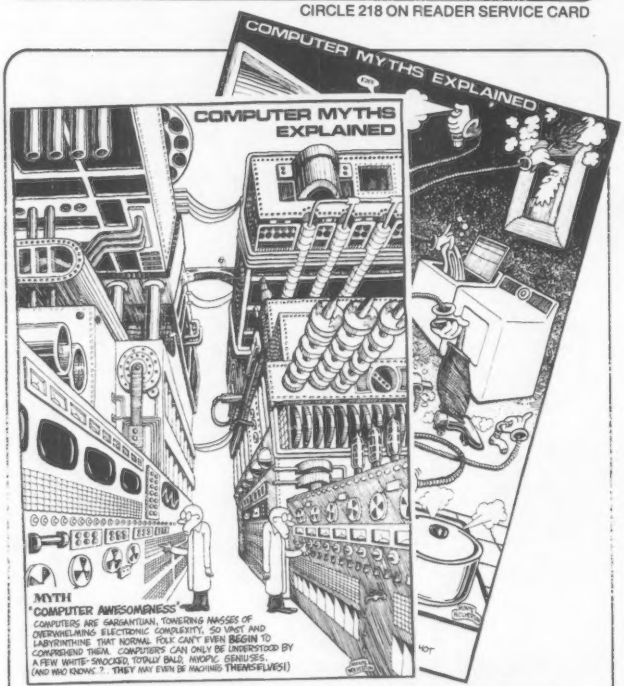
The record is available for $6.00 postpaid ($7.00 foreign) from Creative Computing, P.O. Box 789-M, Morristown, NJ 07960.

CIRCLE 218 ON READER SERVICE CARD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12 Books for Your Holiday Enjoyment

David H. Ahl

Gorey Games by Larry Evans (based on the works of Edward Gorey). Troubador Press, San Francisco. 64 pages, paperback $3.95. 1979.

Features the fascinating, humorous, macabre characters of Gorey's short mystery stories. The book is packed with strange hidden picture puzzles, cryptic codes, mazes and many other maddening games. Nifty, intricate, "modern" Victorian-type graphics coupled with the off-beat games make this book ideal entertainment while you're waiting for Dracula on The Late Show.

Toy Book by Steven Caney. Workman Publishing, New York. 176 pages, paperback $3.95. 1972. (Available from Creative Computing Book Service.)

From the cover: "Toys which work. Toys which are inexpensive. Toys which are easily repaired. Toys which parents and children make together. Toys which are fun." 51 toys in all including a kazoo, barometer, racing spool, picture puzzle, propeller stick and color jar. Remember being frustrated as a kid because books like this always call for things you didn't have? No problem with this book - it requires materials that people really have in the house. We like it.

Star Games by Jim Razzi, Rick Brightfield and Jack Looney. Bantam Books, New York. 128 pages, paperback $6.95. 1978. (Available from Creative Computing Book Service.)

This series of pencil-and-paper games is woven against a space adventure story which runs through the book. The cover is a "computer wheel" with codes and calculations used in several of the games. The reader becomes part of the story which gives one a real sense of participation in the games. A nice bonus is that the book uses facts where possible so the reader/player can acquire real knowledge about binary numbers, space technology, navigation and the galaxy. Fully illustrated. Some games are rather complex so we recommend this book for age 12 and over.

Calculate! by Sid Sackson. Pantheon Books, New York. 80 pages, paperback $2.95. 1979.

From the introduction: "Over the years I have had a number of "great" game ideas that never came to fruition. Although the basic play was intriguing, the "bookkeeping" turned out to be so laborious that the games were more work than fun. Then along came the pocket calculator, which, with the flick of a finger, handles all the drudgery. With much relish I returned to some of the ideas I had put aside - and this book is the result. In all six games the calculator is used as a tool, while the play takes place on the removable sheets - and in the players' heads." These are games of thought although elements of chance are involved. All are quite different and fascinating. Four are for up to 4 players; two are for 2. Recommended for number game lovers age 12 and over.

The Clue Club by Charles Barry Townsend and Dwight Dobbins. Bantam Skylark, New York. 64 pages, paperback $1.50. 1979.

In this cute book, all-American boy Mike Miller, arch villian Roderick Sneakwell, a robot named PAL, and all their friends set out across town to go to the National Puzzle Convention. All along the way they are confronted with puzzles, riddles, and problems. Creative's puzzle editor, Barry Townsend, has dug deep in his rich collection for the scores of puzzles in this book, most of which he has given a new twist. Dwight Dobbins' delightful cartoon drawings help to make this book a must for puzzle fanciers of all ages.

The Big Book of Board Games by Laura Palmer illustrated by Fifi Weinert and Tom Beaudrot. Troubador Press, San Francisco. 32 pages, paperback $2.95. 1979.

In this delightful book the authors have assembled 14 classic board games for the reader to play and color. Yes, it's a coloring book, but it also contains some fascinating, and not widely available games such as Nine Men's Morris, Senet, Goose, Shove Ha-Penny and others. Of course, you won't want to play some games such as Backgammon or Chinese Checkers from a book like this but the fascinating, intricate patterns are fun for children to color. The large format (10" x 12½") and heavy paper mean this book will last for many hours of play.

Computer Games by J. Victor Nahigian and William S. Hodges. Winthrop Publishers, Cambridge, Mass. 157 pages, paperback $10.95. 1979.

This is a bit like Carter critiquing Ted Kennedy's presidential campaign. Another games book as good as either of mine? No way! Well, judge for yourself: 29 games in 157 pages in this book compared to 101 and 84 in 185 pages in my two books respectively. On the other hand, the listings are larger (one column per page instead of two) and some of the descriptions longer. The games: some new ones such as Fish, Kismet, Poem, Psycho, and Skeedoodle - but, believe it or not, that's it! If you have the two Basic Games books (by Ahl) and five new games are worth $10.95, then get this book, otherwise..

Computer Coin Games by Joe Weisbecker. Creative Computing Press, Morristown, New Jersey. 84 pages, paperback $3.95. 1979.

From the introduction: "In twenty-five years of designing computers and inventing games, I've seen a number of interesting teaching aids for binary numbers and computer circuits. The Penny Switch described in this book is one of the best and least expensive. This approach also lends itself to a variety of games, some old, some new. All of these games could be constructed with lights, switches and transistor circuits. They would be more expensive and you wouldn't get to see exactly how they work since the paths taken by electrical signals aren't visible. The Penny Switch lets you actually trace the path of electrical signals through various simple computer circuits." The book contains 32 full size game boards; just add pennies and you're in for hours of fun and learning.

Merlin's Puzzler 3 by Charles Barry Townsend. Hammond, Inc., Maplewood, New Jersey. 122 pages, paperback $4.50. 1979.

From the jacket: "An unusual & out-of-this-world collection of puzzles, games, magic, teasers, quizzes & assorted mind-expanding exercises." Similar to the first two volumes (available from Creative Book Service for $7.50 per set), this third volume is lavishly illustrated with Victorian and turn-of-the-century graphics and written in a wonderful style as though you, the reader, and the author are visiting Merlin's Magic Isle together. Several of Prof. Hoffmann's classic Victorian puzzles are presented here. Although you may have seen some of these old-timers before, the hundreds of other puzzles and teasers, all subtly edited by Barry Townsend, along with Galactar, a marvelous new game, make this book a must for puzzlers of all ages.

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The Way To Play by The Diagram Group. Bantam Books, New York. 320 pages, paperback $7.95. 1977. (Available from Creative Computing Book Service.)

Perhaps the most comprehensive encyclopedia of games in the world. Includes descriptions of over 2000 games and indoor pastimes with over 5000 diagrams for play. Major groups of games include: race board, strategic board, tile, card, target, solitaire, dice, table, casino, private gambling, word and picture, chance and children's. If you're writing a new computer game or looking for the rules to an old one, this is the place to start. Indispensable.

The Programmer by Bruce Jackson. Doubleday & Co., Garden City, NY. 281 pages, fiction $8.95. 1979.

Computer age Robin Hood strikes back. Forty year old programmer working for the City of Buffalo is overwhelmed with too many bills and bad credit rating (partially due to bad computer data). Angry, he pilfers access codes for FBI, credit data bureau, municipal and corporate on-line computers. Playing Robin Hood, he moves funds from the "rich" to the poor and to his own pocket, establishes new identity and disappears to the north woods. Meets lovely 28-year old girl longing for sex and fun, and happily indulges while continuing to create mischief for American Express and "naughty" politicians, easily outwitting the computer traces on his activities. Easily escapes - almost.

Unlikely? Yes. Unfortunately, despite the jacket notes that it's all quite authentic and plausible, it lacks the ring of truth. For example, "He had gotten to the point where he could ask twenty different computers, WHAT CAN YOU TELL ME NOW? and the computers would neatly type back for him questions he might wish to ask sometime." Nice, very nice. **Nevertheless, it's a well told story that will keep you interested from start to end and provide a nice break from Super Invader or Adventure.**

Running Wild by Adam Osborne. Osborne/McGraw-Hill, Berkeley, Calif. 182 pages, paperback $2.95. 1979.

From the introduction: "We are already five years into a new industrial revolution, the impact of which will rival the first industrial revolution. This was created by the semiconductor industry. Technological advances and price reductions have brought about a revolution because no one has been able to predict what would happen, or plan for it." The book goes on to describe the roots of the industry, and its effect on people, jobs and machines in the next twenty-five years. Few readers could argue with the facts presented by the author, although many might take issue with opinions presented as fact. For example, "The robot of the future will be able to hear spoken words and non-verbal sounds and will be able to respond to what it hears. It will be able to combine what it sees and hears with the movements of its limbs to perform any task that can be explicitly defined. It will be able to speak with an extensive vocabulary. Robots will eliminate 90% of assembly line jobs within twenty years." Well, maybe.

Or try this one: "Within five years IBM will no longer be a significant supplier of computer systems." Or this, "Before 1990, microcomputer systems sold out of computer stores will account for ninety percent of the entire computer market." **Numbers or dollars, one might ask? Looking for career in** computers? The NY Times forecasts a 25% increase in the demand for programmers in the 1980's. But according to Osborne, "Within 25 years there may well be almost no programming jobs left. Why not? Because, says the author, "computers will be 'self-programming' and will be programmed by example." But whether or not you agree with the opinions stated or enjoy the rather professorial writing style, the book has enough thought-provoking material that it probably should be on your shelf.

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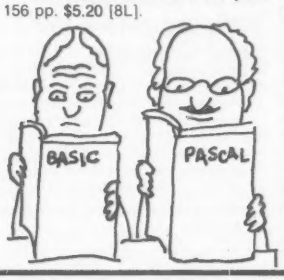
A Guided Tour of Computer Programming In BASIC

Dwyer and Kaufman. This book tops all introductory texts on BASIC. Filled with detail and examples, it includes sample programs for many simulations, several games, reservations systems and payroll. Aimed at the novice, but of value to everyone. 156 pp. $5.20 [8L].

BASIC Programming, 2nd Edition

Kemeny & Kurtz. An introduction to computer programming through the language of BASIC. The authors include in-depth discussions of many applications including files and text processing. 150 pp. **$10.95** [7E]



Basic For Home Computers

Albrecht, Finkel, & Brown. This book shows you how to read, write, and understand the BASIC programming language used in the new personal-size microcomputers. Includes detailed descriptions of everything you need to know to make your computer work for you—includes how to get started, numerous applications and games, lists of resources, much more. 332 pp. $6.95 [7G]

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PASCAL User Manual and Report (2nd Edition)

Jensen & Wirth. This book consists of two parts: the User Manual and the Revised Report. The Manual is directed to those who have some familiarity with computer programming and who wish to get acquainted with the PASCAL language. The Report is a concise reference for both programmers and implementors. It defines Standard PASCAL, which constitutes a common base between various implementations of the language. $7.90 [10B]

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Dr. Roger Kaufman. This book is one of the most entertaining computer programming books around. Learn computer programming the "painfully funny way." Filled with examples and illustrations plus a light sprinkling of jokes. Guaranteed to teach you FORTRAN. 273 pp. $6.95 [4D]

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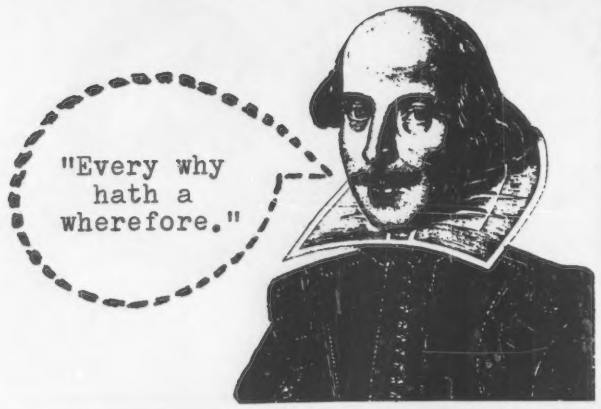

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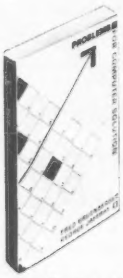

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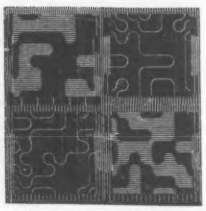

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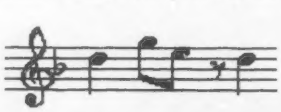
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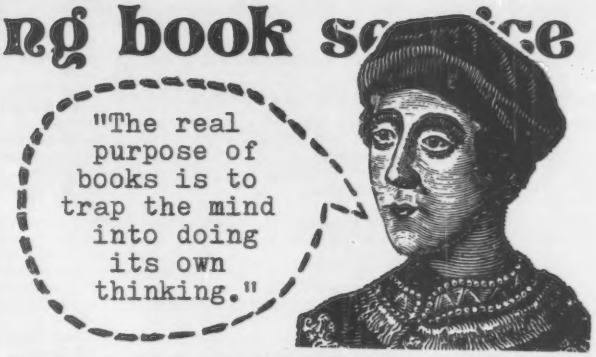

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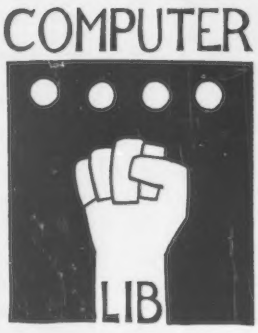

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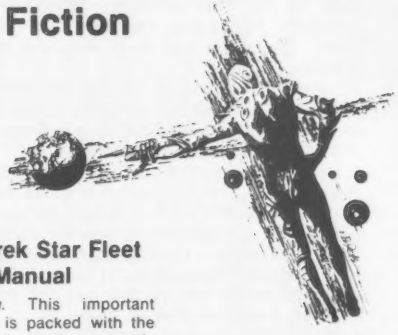

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Puzzle Answers.

1. The puzzle can be solved using 12 strokes. In the figure start at point **A** and follow the lines around to point **B.** The two curved lines are drawn one above the other.

2. The sequence represents the same number, number 16, in different bases starting with base 16 and working down to base 3. The answer to our problem is 31.

3. Card 4 is **not** included in our answer. We can eliminate card 2 because it is green. Now, if card 1 should have a circle on the other side the answer would be no. If card 3 should be red on the other side the answer would also be no. On the other hand, if card 1 is a square, and card 3 is green, and card 4 is red or green then the answer is yes. The solution then is to turn over cards 1 and 3.

4. Every part of a wheel revolves around the center axis at a fixed speed when the wheel is **fixed** in place, as in the case of a waterwheel. When a wheel is in motion along a path, as is the case with a wheel on a car, then the top part of the wheel must be moving forward at a faster speed or the car would be stationary, as happens when you are caught on a patch of ice. In Figure 1 we will examine the two points on the wheel depicted in the drawing on page 66 and follow their movements through one half of a revolution of the wheel. As the wheel moves forward, from left to right, point **A,** starting at position **A1,** travels along a downward path. Note that when it reaches position **A2** point **B** has reached position **B2.** The distance that point **B** has traveled is a great deal less than the distance traveled by point **A,** thus point **A** must have traveled at a greater rate of speed than **B** in order to have covered this greater distance in the same amount of time. However, when point **A** moves from position **A2** to **A3** point **B's** speed increases while point **A's** speed decreases. This proves that a point on a wheel travels slowest at the bottom and fastest at the top.

5. The answer, of course, is that you turn the post in the hole until the "Bradbury Junction" sign points back the way you came. The other two arms will now be pointing correctly.

Problem 2: You point to one of the forks in the road, and ask the question, "If I were to ask you if this is the right road to Andersonville, what would you tell me?"

Let us assume that you have pointed to the right fork. If the individual is a man, he would tell you that the fork is the right fork. Since you have asked him how he would answer, he replies, "I would tell you that this is the road to Andersonville." If he is a robot, he would lie and tell you that that isn't the road to Andersonville. In reply to your question "What would you tell me?", he must lie and say, "I'd tell you that it's the road to Andersonville."

In other words, that man must tell the truth about telling the truth, while the robot must lie about the lie he would tell. And a lie about a lie equals the truth.

The exact same reasoning tells us that if you point to the wrong road, both will tell you that it's the wrong one to take.

6. See diagram.

	1	4	
11	6	7	2
8	10	3	5
	9	12	

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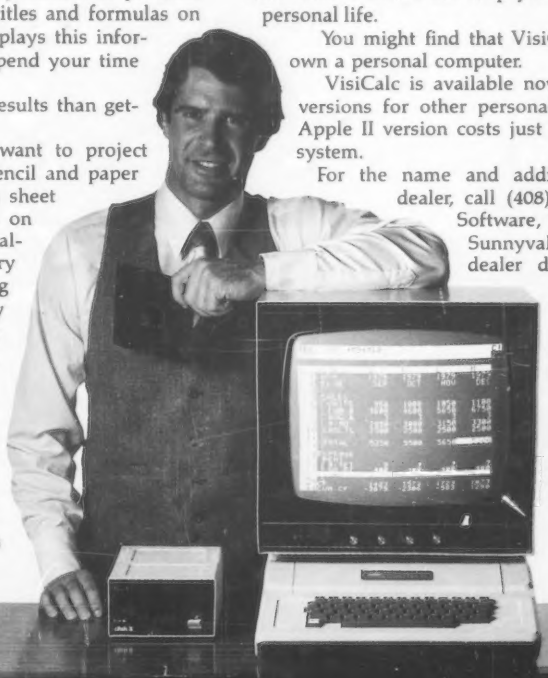

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C1P: $349 A dramatic breakthrough in price and performance. Features OSI's ultra-fast BASIC-in-ROM, full graphics display capability, and large library of software on cassette and disk, including entertainment programs, personal finance, small business, and home applications. It's a complete programmable computer system ready to go. Just plug-in a video monitor or TV through an RF converter, and be up and running. 15K total memory including 8K BASIC and 4K RAM—expandable to 8K.

C1P MF: $995 First floppy disk based computer for under $1000! Same great features as the C1P plus more memory and instant program and data retrieval. Can be expanded to 32K static RAM and a second mini-floppy. It also supports a printer, modem, real time clock, and AC remote interface, as well as OS-65D V3.0 development disk operating system.

Professional Portables

C4P: $698 The professional portable that has over three times the display capability of C1Ps. Features 32 x 64 character display in up to 16 *colors*, graphics, audio output, a DAC for voice and music generation, key pad and joystick interfaces, AC remote control interface and much more. Utilizes a 4-slot BUS (2 used in base machine), 8K BASIC-in-ROM, 8K of *static* RAM and audio cassette interface. Can be directly expanded to 32K static RAM and two mini-floppy disks.

C4P MF: $1695 The ultimate portable computer has all the features of the C4P plus real time clock, home security system interface, modem interface, printer interface, 16 parallel lines and an accessory BUS. The standard machine operates at twice the speed of currently available personal computers (with GT option it runs even faster!). The C4P MF starts with 24K RAM and a single mini-floppy and can be directly expanded to 48K and two mini-floppies. Available software includes games, personal, business, educational and home control applications programs as well as a real time operating system, word processor and a data base management system.

*Monitors and cassette recorders not included. Ohio Scientific offers a combination TV/Monitor (AC-3P) for $115.

Home/Small Business Systems

C8P: $895 Same great features as the C4P in a tremendously expandable "mainframe package." Features over three times the expansion capability of the C4P for advanced home and demanding business applications. Can be expanded to 48K RAM, dual 8" floppies, hard (Winchester) disks and multiple I/O devices such as Voice I/O and a universal telephone interface.

C8P DF: From $2597 The ultimate Home/Very Small Business Computer at a personal computer price. Features 32K RAM (expandable to 48K) and dual 8" floppy disks (stores eight times as much information as a mini-floppy). Has all personal computer capabilities including 32 x 64 display, color graphics, sound, DAC, joystick interfaces, home features including real time clock, AC remote interface, home security and fire detection interface and can be expanded to include voice I/O and a universal telephone system for answering and initiating calls! Its large memory capability and 8" floppies allow it to run most Ohio Scientific business system software including a compete accounting system, word processor and information management system.

For literature and the name of your local dealer, CALL 1-800-321-6850 TOLL FREE.

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CIRCLE 214 ON READER SERVICE CARD